MILL SECTION of
Concrete

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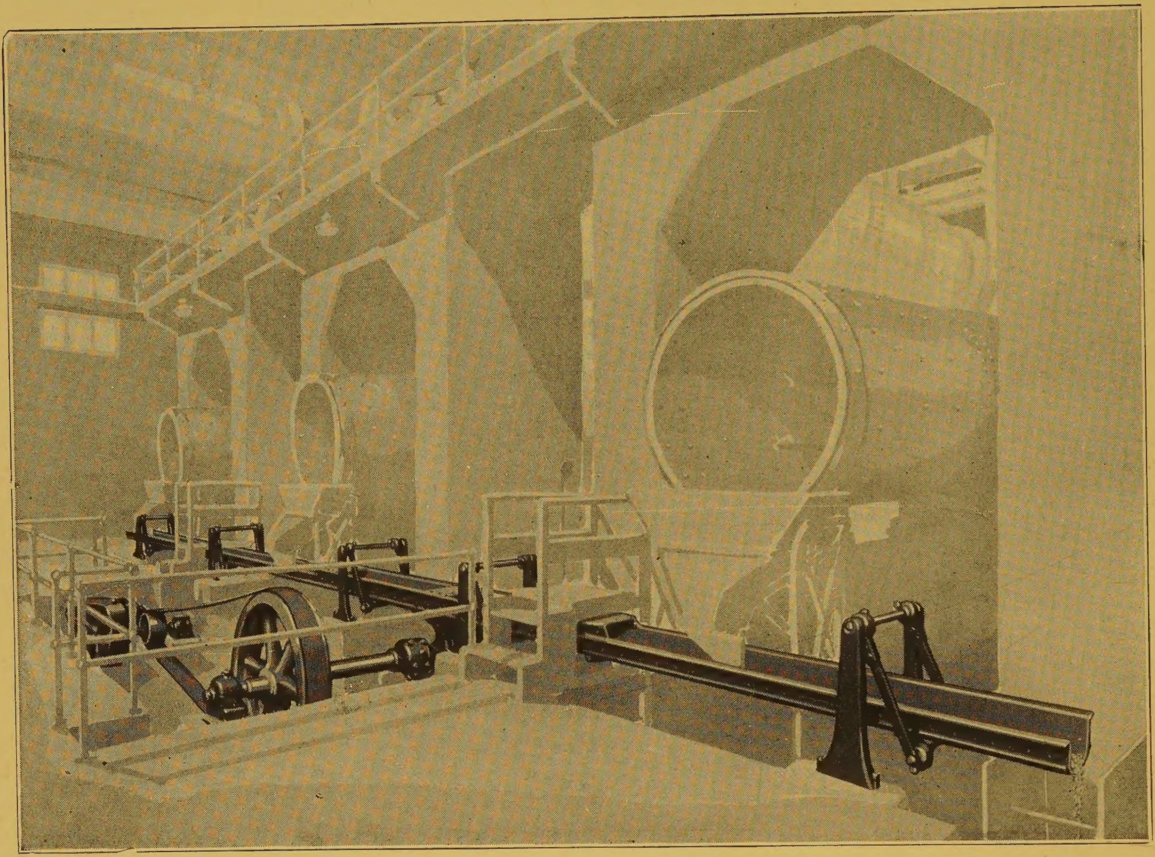

A Skipulter installed in a western cement plant, where it is conveying cement clinker, discharged from three coolers, to an elevator

THE Skipulter is an improved type of shaker conveyor for transporting coarse materials, such as cement clinker, coal, ore, slag, rock, limestone, etc.

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This type of conveyor is one of the simplest means of conveying materials, economical to operate, requiring very little horsepower, and is a simple solution to many conveying problems.

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MILL SECTION of
Concrete

The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

Volume 33 September, 1928 Number 3

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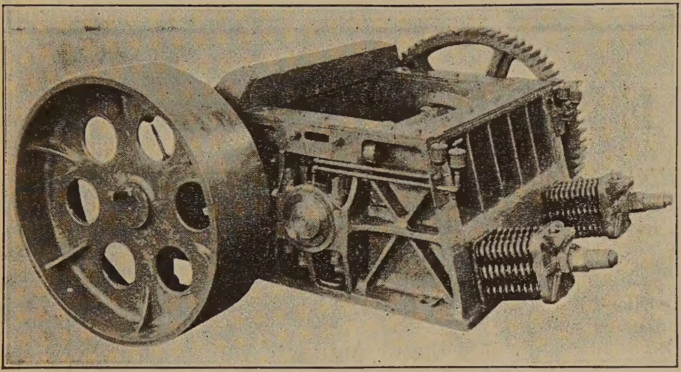

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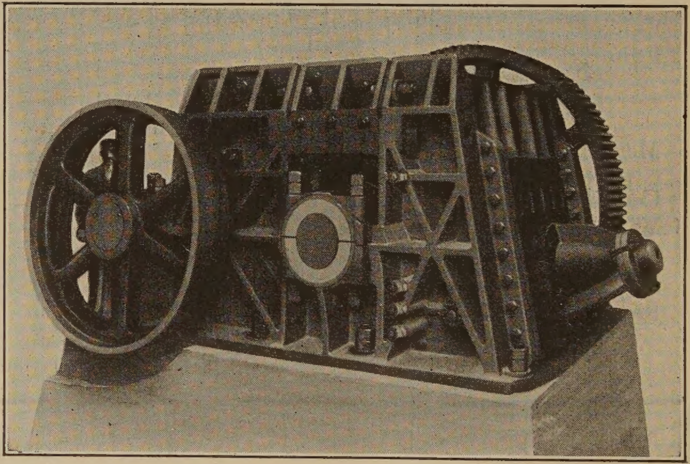

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MILL SECTION of

Concrete

Vol. 33 Chicago, September, 1928 No. 3

The Preparation of the Raw Mix by the Dry Method

Uniformity of Raw Mix—Ideal Condition of the Raw Mix—Effect on Burning—What Is a Homogeneous Mix? —Correcting the Mix—Wet vs. Dry—How to Blend with the Dry Method

By MARC ELBER

HIGH early strength cements are the order of the day. It is established and admitted that these products are not exceptional in their composition and that they are portlands manufactured under careful supervision of all phases of manufacture, from grinding of the raw materials down to the grinding of the finished product.

It is acknowledged that the principal factor controlling quality lies in the uniformity of composition of raw materials, conditions determining satisfactory calcination.

By uniformity of composition the author does not mean constant composition alone; his thought reaches further and takes in homogeneity of raw materials, their constitution, the physical state of their constituents; their size, relative position and distribution throughout the mass.

Ideal Condition of the Raw Mix

Whether the phenomena taking place during calcination of cement are taken to be actual chemical reactions between molecules of the compounds CaO, SiO_2 Al_2O_3 and Fe_2O_3 or a solid solution of CaO in a magma of a more or less definite chemical composition, it is clear that the ideal condition of good calcination is that CaO, SiO_2, Al_2O_3 and Fe_2O_3 must be present in the raw mix divided in a molecular state and in accordance with the proportions in which they are desired to appear in the final product. This ideal condition is even more important in the case of clinkerization. If the old saying: "Corpora non agunt nisi soluta" (bodies do not react except in solution or in a liquid state) is true, clinkerization diverges considerably from conditions required to obtain a good reaction. Solution or fusion generally reduce the substance to a molecular state—except in the case of polymerization, or of the opposite condition, ionization—and diffusion proceeds to disperse the molecules thus separated throughout the mass and with great uniformity. This homogeneization is accomplished in a period of time directly proportional to its fluidity. It follows, that during clinkerization when the temperature can be assumed to be sufficient to reduce the compounds to their molecular state, the lack of fluidity in the mass would confine diffusion to a small space directly surrounding each molecule.

Thus, if a homogeneous clinker is to be desired, it is obviously necessary that the raw mix be homogeneous when calcined. Yet, what do we understand by the term "homogeneous"? It has a meaning which is extremely elastic. We will begin by trying to define this term.

We will suppose that we have to study the homogeneity of composition of a silo of raw materials. For this purpose we will take 1 gm. samples from different parts of the mass which we will proceed to analyze. This is the only method by which our purpose can be accomplished.

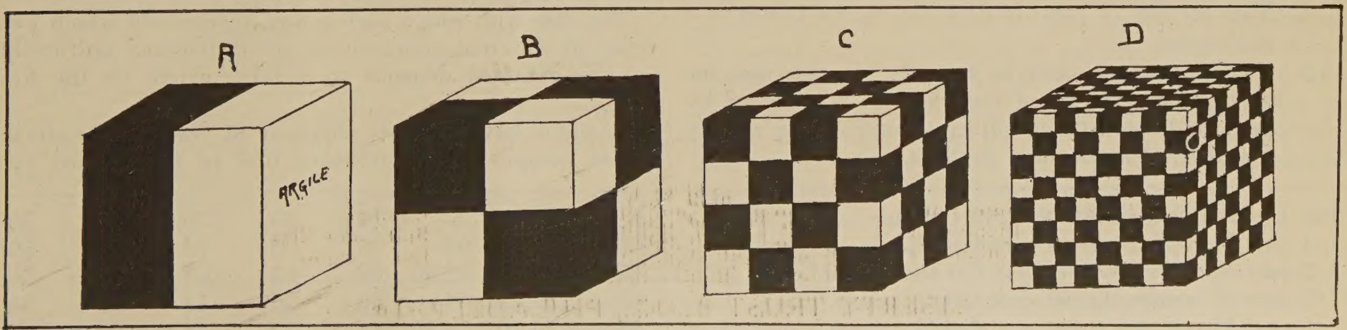

Figure 1

Translated from Rev. des Materiaux de Constr. et de Trav. Publics.

Supposing, for the sake of concrete data, that 10, 20, 100 samples of 1 gm. have given each time an analytical result of 50 per cent $CaCO_3$. Anyone would admit that the mix contained in the silo is homogeneous.

Let us see what can take place inside one gram of substance which we have used for our determinations. Let us place the gram into a cube which will be completely filled by its volume.

The cube may be filled with a mix whose every particle contains 50 per cent $CaCO_3$; this is the ideal case. However, if our cube is made up in part of a mix of 49 per cent and in part of 51 per cent, an analysis of the whole will still yield 50 per cent $CaCO_3$. Similarly a cube may contain equal parts of 48 per cent and 52 per cent or 47 per cent and 53 per cent and so on down to a mix of equal parts of 100 per cent and 0 per cent $CaCO_3$.

Can we call such mixtures homogeneous? Certainly not! Yet what method have we to take account of this difficulty? None. The microscope will give us only vague indications of no practical value.

However, if we calcine this sample (Fig. 1, A) composed of 0.5 gm. pure $CaCO_3$ and 0.5 gm. shale, we will obtain 0.28 gm. CaO and a little less than 0.5 gm. calcined shale with a certain quantity of cement at the surface of contact of the two constituents—assuming that a mix of equal parts of limestone and shale will yield cement—of a thickness of a small fraction of a millimeter. The operation of mixing this sample can be represented in Fig. 1 as A, B, C and D.

It is obvious that absolute homogeneity increases from A to D. The small ideal cubes imagined inside the large primary cube decrease in volume. When their dimensions reach the same value as the thickness of cement considered above, we will have attained the conditions required to produce good calcination.

These dimensions range around 1/100 of a millimeter, i. e., they represent approximately the fineness obtained in up-to-date mills.

This example shows that the control analysis as practiced in all cement plants yields but the average composition of 1 gm. of the raw mix, but gives us no indications of the intimate constitution of the mix within the limits of this gram.

It follows that having no method to control this intimate homogeneity, we will have to feel our way and set up precautionary measures which will insure that the mix will be more than satisfactory.

Effect on Calcination

We can thus formulate the following rule:

To insure complete and uniform calcination of the raw mix at the ordinary clinkerization temperatures of cement kilns, it is necessary:

1. That the size of particle does not exceed 1/100 of a millimeter.
2. That the homogeneity of the mix be such that the average composition of the whole as represented by each particle with its adjacent particles be exactly that desired in the final product.

The second point deserves being substantiated by an example.

Let us consider raw mixes of equal average composition, but of different minute structure, each containing 50 per cent $CaCO_3$ obtained by the mixture of two different materials:

Ref. No.	Parts C	Parts M
1	1	1
2	1	2
3	1	5
4	1	10
5	1	50
6	1	100

Each of these mixtures, in turn, may be combined in an incalculable number of ways, according to the composition of the two materials. For example Mix 1 may be composed of:

	Parts C		Parts M
No.	Per Cent $CaCO_3$	No.	Per Cent $CaCO_3$
1	0	1	100
1	2	1	98
1	5	1	95
1	10	1	90
1	20	1	80
1	30	1	70
1	40	1	60
1	50	1	50

The table below shows some of the possible combinations within the range of the six mixtures listed, with values of C increasing from 0 to 50 per cent. The figures in the columns under M show the per cent $CaCO_3$ necessary to obtain, in each of the six mixtures, 50 per cent $CaCO_3$ with the given per cent $CaCO_3$ of C indicated in the column opposite.

Thus from the point of view of constitution and homogeneity, the uniformity of the mix depends on two factors:

1. That inherent in the materials of which it is composed.
2. That acquired by mechanical mixing.

The former factor cannot be modified, except to a limited extent, as, for example, by excluding from manufacture deposits of shale whose composition varies too much from that of the finished product. The ideal condition in this connection is the manufacture of natural cement.

Correcting the Mix

Though the first factor cannot be modified, it is fortunately possible to correct it by introducing the second factor, i. e., mixing raw materials of incorrect composition to a composite mix of desired constitution and grinding this mix fine enough to make it homogeneous from the standpoint of clinkerization.

The ease with which such a mix, throughout which particles of different composition are distributed uniformly, can be obtained depends to a large extent on the first factor.

A plant having at its disposal at least one material whose composition approaches that of the desired raw

For 1 part C containing per cent $CaCO_3$	0	2	5	10	20	30	40	50
1 part M containing per cent $CaCO_3$	100	98	95	90	80	70	60	50
2 part M containing per cent $CaCO_3$	75	74	72.50	70	65	60	55	50
5 part M containing per cent $CaCO_3$	60	59.60	59	58	56	54	52	50
10 part M containing per cent $CaCO_3$	55	54.80	54.50	54	53	52	51	50
50 part M containing per cent $CaCO_3$	51	50.96	50.90	50.80	50.60	50.40	50.20	50
100 part M containing per cent $CaCO_3$	50.50	50.48	50.45	50.40	50.30	50.20	50.10	30

mix has more chance to obtain a homogeneous mix than one in which all the materials differ from the final composition to a considerable extent.

Let us assume that plant A uses a shale of 73 per cent $CaCO_3$ and a limestone of 93 per cent $CaCO_3$

Plant B has a shale of 58 per cent $CaCO_3$ and a limestone of 96 per cent $CaCO_3$.

It follows that, in order to obtain a mix of 77 per cent $CaCO_3$, plant A will use its limestone and shale in the ratio of 1:4 while plant B in that of 1:1.

Thus, supposing that all the ingredients are ground to the same fineness, the first mix would require that each particle of limestone be in contact with four particles of shale to achieve homogeneity; in the second case, each particle of limestone should be in contact with but one particle of shale. The chances of satisfying these conditions are proportional to the number of combinations possible within the two systems. The theory of probabilities tells us that these chances will be twelve times as numerous in A as they will be in B, which means that the absolute homogeneity will be reached twelve times as rapidly in plant A as it will be in plant B.

Evidently, this is a theory whose practical application disproves its conclusions. Nevertheless, these theories present valuable indications in the case of starting a new plant.

From the practical point of view, which is of utmost interest to us, we can say that the aptitude of a pulverized mix of two substances to form a homogeneous whole by mechanical mixing is at a minimum when the two constituents are present in equal amounts and increases with the increasing proportion of one or the other of the elements, reaching a maximum at the ratio of about 1:25.

The above questions are but of relative importance, for *it is always possible* to obtain a mix adaptable to the calcination of a high strength cement, providing the raw materials contain the compounds CaO, SiO_2, and Al_2O_3—with Fe_2O_3 of secondary importance—permitting their combination in accordance with the proportions desired and providing no harmful element is present. The form in which these compounds are present is of little importance nor in what proportions they are combined in the materials. The problem is reduced to more or less intense mixing and grinding.

We will not discuss here the problem of grinding; it may be considered as solved definitely and as having kept step with the general progress accomplished in the cement industry. There is not one machine company in existence today which cannot deliver a mill to a plant operated by the wet or the dry process, which will economically pulverize the hardest materials, reducing them to a fineness required by high early strength cements.

Wet vs. Dry

Concerning the problem of mixing, a simple and effective solution is furnished by the use of the wet process. Any mixing tank, supplied with mechanical agitators with possible use of compressed air, will in one half hour reduce the most heterogeneous mix to a perfectly homogeneous paste, provided that the materials are previously ground to sufficient fineness.

The mixing of powdered materials by the dry process has been subject to many controversies which have not yet subsided.

As frequently happens in such cases, exaggerations have been indulged in by both parties: the advocates of the dry and of the wet process and the truth, as usual, is to be found in between.

In the course of the author's professional career, he has had to run a plant operating by the dry process and later one using the wet process, both plants using rotary kilns. His judgment, therefore, carries no partiality—not even unconsciously—for every person is prone to advocate what he knows best.

Thus, the author will refrain from criticizing one process to the advantage of the other, for he is convinced that both yield products comparable from the point of view of quality. This is stated in reply to contentions made by engineers and others interested, but little informed, parties, that cements obtained by the dry process cannot equal those obtained by the wet process.

Each process has its advantages sanctioned by practical results. Both are effective, which permits them to remain in competition with each other.

It is not to be denied that the wet process has a higher fuel consumption. The author will not pretend to make a comparison of the heat balance of the two processes at this time, yet no one will deny that the higher fuel consumption of the wet process—3.5 per cent of the clinker produced, according to original computations and observations—is not compensated for by the omission of drying the raw materials. On the contrary, kilns receiving a charge of dry material, if not provided with waste heat boilers, discharge their hot gases into the dryers, so that the cost of drying becomes nearly negligible.

Having admitted this advantage of the dry process together with all those accorded to it by practical men, let us consider the main objection raised against it; namely, the difficulty of mixing the dry meals.

The Dry Method

It is easy to see that this objection is not without foundation and that it is even quite serious, for from the mechanical standpoint, dry mixing is far from able to compete with slurry mixing as regards ease and speed of operation.

The author does not say that it is impossible by the dry process to obtain a meal as homogeneous as it is in the cement slurry—far from it! He wants to state only that to make it possible, the following rules be complied with:

1. A properly designed mixer must be available.
2. The mix should be carefully worked under rigid control and, most important of all, in a logical and rational manner. The mixing will consume more time than it does in the wet process, yet the product will be in no way inferior to that of the latter.

Dry process mixing is obtained with a series of silos of sheet steel or reinforced concrete, generally cylindrical in shape and truncated below, and arranged in two rows. Each of the silos is provided with a screw discharge—2, 3 or 4 screws per silo—which may be worked separately, so that the quantity drawn may be proportional respectively to 1, 2, 3 and 4 per unit of time. One or two or even all four of the silos can discharge at the same time. The meal can be discharged at will on either one of two parallel conveyors, which take it to a bucket elevator discharging the material at the upper level of the silos on either of two conveyors parallel to the axis of the silos and capable of feeding any one of the silos. This arrangement permits the following combinations:

1. The raw materials may be taken from one silo and discharged back into the same silo.
2. The raw materials may be taken simultaneously from several silos and in the desired proportions and may be discharged into another silo.
3. The above processes may be used simultaneously.
4. The raw materials may be drawn from several silos

and discharged into another, while simultaneously the raw materials from another series of silos is discharged into yet another silo.

5. The two conveyors at the lower level may feed the conveyor leading to the kiln storage, so that one may proceed at the same time as in 1 and 2 and send the meal to the kiln.

No matter what its details of construction, up-to-date dry mixing must be able to satisfy the conditions necessary and sufficient for perfect operation.

Yet the best method will give poor results if it is not used in a rational manner.

One might imagine, that when the average proportions registered for hour to hour and half hour to half hour by the automatic removal of samples, yield the exact $CaCO_3$ content adopted for the raw mix, the mix can be fed directly to the kiln without any further preparation. This were true, if *all the proportions* yielded that $CaCO_3$ content; when this is not the case, an error explained below creeps in whenever the mix is considered adequate.

Blending While Filling and Emptying Silos

Let us follow out logically, if only diagrammatically, the course traversed by the raw materials in the mixing silos, when it enters and when it leaves the silos.

When a silo is being filled, it is obvious that its upper surface assumes the shape of a cone, the slope of whose side surface depends on a large number of causes, such as the hygrometric state of the meal, its fineness, density, etc., and varies from 30 to 40 degrees. This conical shape is maintained until the silo is filled. It follows that the material has become accumulated in actual layers of the same conical regularity and superimposed on one another.

When a change of composition has taken place during grinding, we will find that the raw materials in the silo have formed just as many conical layers of different composition, as the number of times the composition of the mix was varied. Let us suppose that 5 such abrupt variations took place at regular intervals during the filling of a silo. We will have five conical layers of different composition which we will designate A, B, C, D and E (Fig. 2).

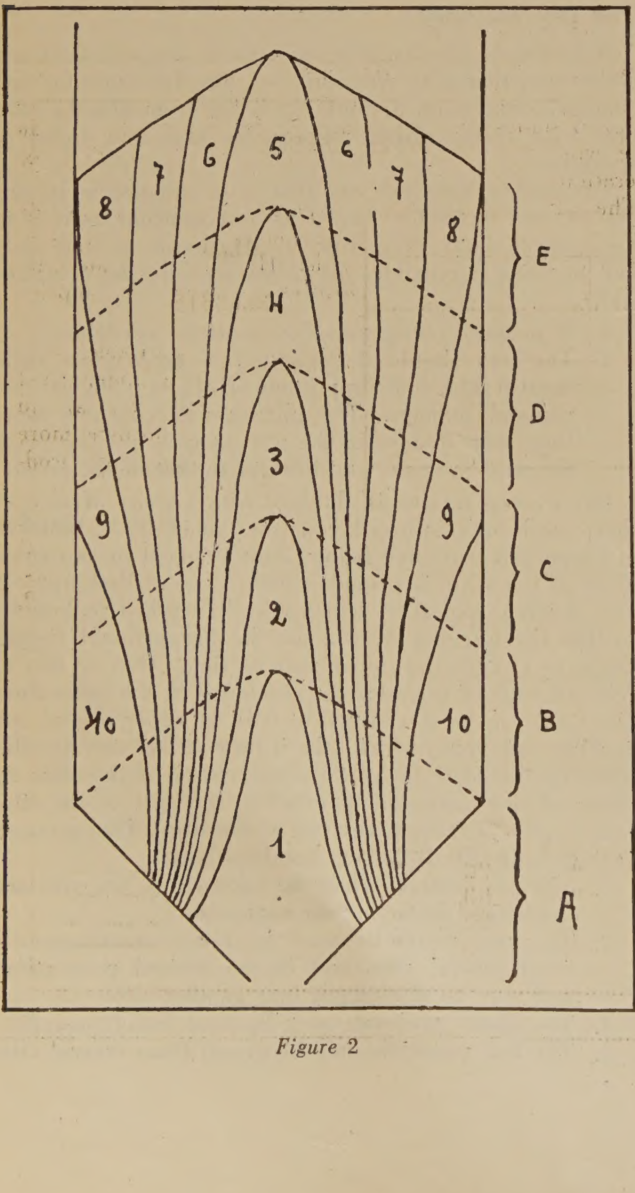

Figure 2

In emptying the silo, the material does not leave it in the same sequence as it enters it; this is very important for the whole dry process of mixing depends on the inversion of this order. Without it, mixing would be impossible.

Among the factors controlling the discharge of pulverized materials, too many are of an empirical character to formulate a law of any value, such as that of the discharge of liquids through narrow orifices. We have to deal with such factors as: fineness, density, humidity, nature of the dusts—all of which are essentially variable. Only one method could give results in studying the discharge of silos: an experimental method applied by the author to a reinforced concrete cylindrical silo of 8m. inside diameter, 18m. in height, a truncated discharge with sides at 45 deg. and an opening of 0.80m. in diameter provided with a drum. The experiments were made with freshly ground cement and in the following manner:

One hundred thirty-six 0.04m. wooden cubes were prepared and were designated in six series: A, B, C, D, E and F. The first series of cubes was placed in the conical bottom of the silo; the other five series were placed at five different elevations following the diameter of the section divided into 20 equal parts, after smoothing the cone. It is obvious that the placing of each series of cubes necessitated an interruption in the filling of the silo, which was resumed only upon leveling the surface and placing the cubes.

The position of the cubes was carefully reproduced on a diagram. We then proceeded to empty the silo, counting the bags of cement. A sieve, placed under the discharge, retained the cubes as they came down with the cement. A boy was employed to watch for their appearance and to report it to a man who noted the fact opposite the number representing the bags of cement filled before the cube appeared.

When all the cubes were collected, the order of their appearance permitted the author to draw a series of curves similar to the isobaric and isothermic curves, i. e., he could connect the points from which the cement left the silo at the same time.

The results cannot be reproduced here in detail. However, the somewhat irregular curves permitted the drawing of a diagram, whose evidence was that expected by the author (Fig. 2).

"Rathole" Discharge

One can see, that although the curves of discharge resemble those of the filling process near the bottom of the silo, they rapidly diverge from the latter. Beginning as regular conical surfaces, the discharge surfaces soon pass to the cylindrical shape and end by becoming an inverted cone, which, if the silo were large enough, would stop when the slope of its sides would coincide with that of the natural slope of the fall of cement, unless the conical

(Continued on page 116)

Sea Water-Resistant Cements

Being a Discussion of Chemical Factors Which Render Portland Cement and Concrete More Resistant to Deterioration When Exposed to Sea Water—What Causes Concrete to Deteriorate in Sea Water—Some Possible Changes in Chemical Composition of Cement That Will Increase Its Resistance—Studies of the Effect of Adding Blast Furnace Slag — Use of Blast Furnace Slag as Aggregate

By GEORGE J. FERTIG
Chemical and Metallurgical Engineer

IN recent months great progress has been made in isolating the character and nature of the destructive agents of sea water in making possible the production of concrete bearing higher resistance to ocean water attack. Most of the recent progress in producing more sea water resistant concrete has come because of intensive investigation on suitable cements themselves. It has been during research on the characteristics of these cements that valuable information has been secured on the question of the other constituents of the concrete mix. Naturally, if properties have been found which are responsible for rendering the binding cement of a concrete resistant to sea water, these same or analogous properties would prove to be effective in the coarse or fine aggregates likewise. There are several possible points of view from which the study of the production of resistant concrete masses might be made. As far as possible, however, the discussion here will be limited to the chemical considerations involved.

One cubic mile of sea water contains over 150,000,000 tons of dissolved mineral matter. Of this enormous tonnage of material it remains, however, for but one tenth

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A paper presented before the Alabama Academy of Science.

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Fig. 1. Relationship of five different mixtures of blast furnace slag and portland cement and their respective resistance to 10 per cent magnesium sulphate solution over the time of 1 year

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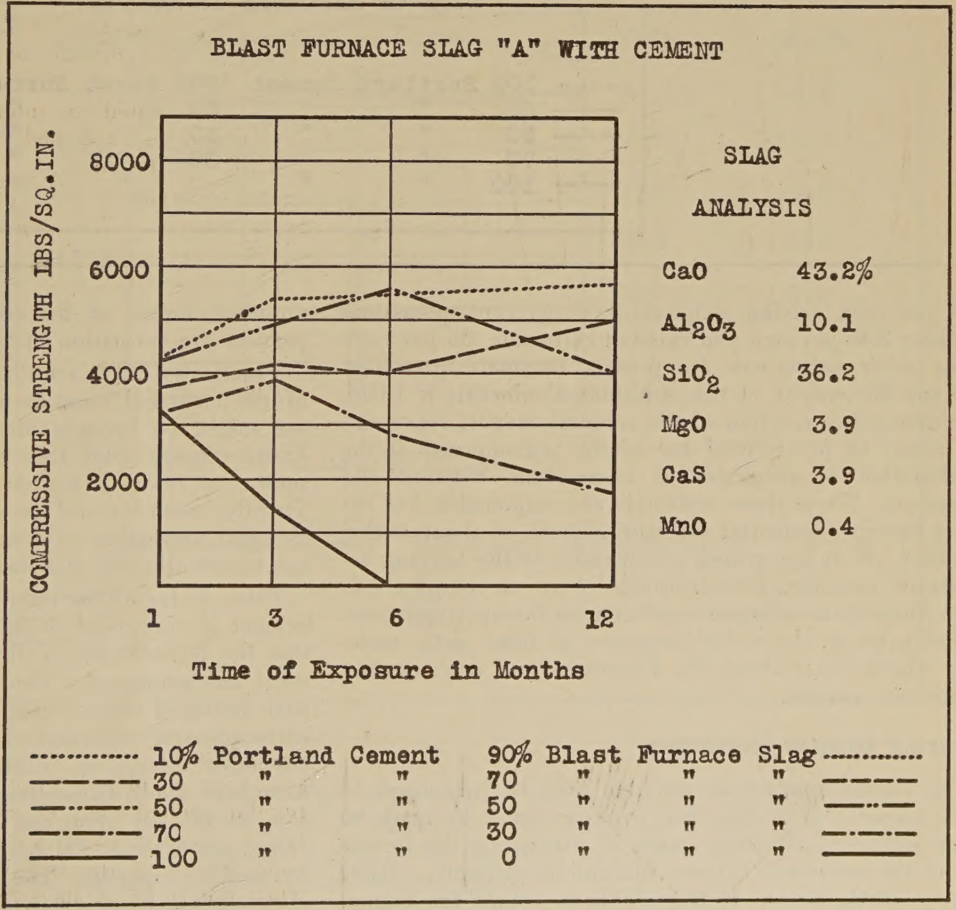

to be responsible for the main chemical and corrosive action on exposed concrete. The most distinctive characteristic of salt water is its saltness; but besides common salt it contains dissolved mineral matter of many other sorts. One hundred pounds of sea water contain 3.44 pounds of this mineral matter. Of this quantity, common salt makes up more than three fourths (77.66 per cent), magnesium chloride 10.88 per cent, magnesium sulphate 4.74 per cent, calcium sulphate 3.60 per cent, potassium sulphate 2.46 per cent and calcium carbonate .35 per cent. Many other substances are present in small quantities. The specific gravity of this solution of minerals is 1.026. The destructive fraction of the mineral matter, representing about 10 per cent of the whole, is composed of the combination of sulphates of magnesium, calcium and potassium. These three materials are responsible for sea water having a potential sulphate content of about .00265 per cent. With the proper constituents of the binding cements of concrete, these sulphates form a complex calcium aluminium sulphate together with the auxiliary compound gypsum. It is the formation of these latter materials which bring about the disruption and deterioration of concrete masses.

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Fig. 2. Relationship of five different mixtures of blast furnace slag and portland cement and their respective resistance to 10 per cent magnesium sulphate solution over the time of 1 year

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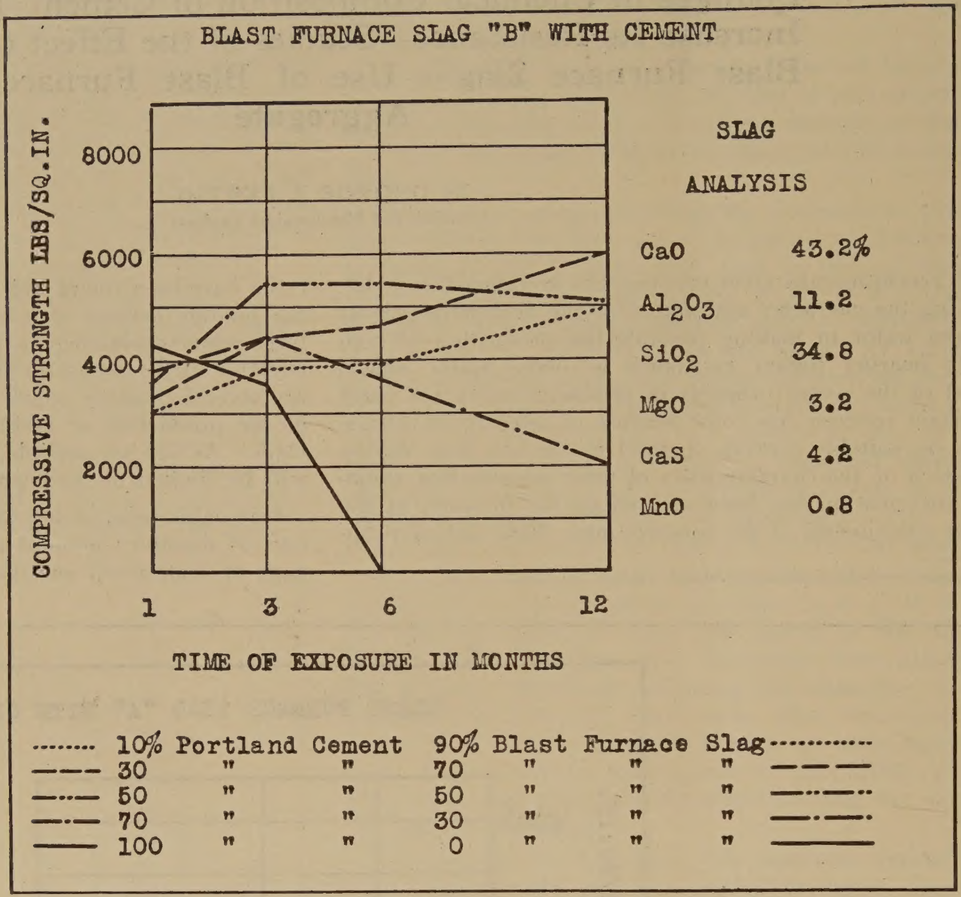

Securing Greater Resistance

The lasting quality of concrete may be prolonged in cases where it is evident that exposure must be made to ocean waters by effecting means of preventing the formation of the compound calcium aluminium sulphate,—$3CaO\ Al_2O_3\ CaSO_4\ 3H_2O$. It is possible to retard the formation of this main objectionable compound by decreasing the concentrations of the factors from which it could form. Since it would be practically impossible to cut down the sulphate content in the sea water, the only recourse open would be to work with the composition of the concretes themselves. From the simple laws of chemical mass action it occurs that anything which would reasonably decrease the available lime content of the cement would discourage the formation of calcium aluminium sulphate. Furthermore, any opportunity to reduce the alumina content of the cement would seem logically to prevent the formation of the undesirable compound.

Practically, there are three ways in which the alteration of the chemical constituents of a cement for sea water use might be brought about to make it more resistant. First, a lower total lime content might be sought. Secondly, a lower alumina content might be attempted. Thirdly, means could be adopted which would prevent the post formation of free lime in the concrete through reactions following the stages in the setting process.

First, as far as the reduction of the lime content of the cement is concerned, it has been known for many years that the replacement of lime by alumina in portland cement has produced a binder more resistant to sea water than portland cement itself. In reality alumina cement is extraordinarily resistant to magnesium sulphate, which is the most dangerous constituent in sea water. Cements have been made whose lime contents have been reduced as low as 40 per cent and whose alumina contents were raised as high as 50 per cent with pleasing results in hydraulic properties. The excellence in resistance of calcium aluminate which is formed in the hardening of high alumina cement has been responsible for many years for this cement being recommended for sea water construction in place of portland cement in several European countries.

Secondly, a lower alumina content might be attempted. Different in principle than would be the case of using alumina to replace lime, is the principle to replace alumina by such a material as iron oxide. It is equally advantageous to cut down the possibilities of calcium aluminium sulphate formed by decreasing the lime and increasing the alumina, as it is to decrease the alumina by some unconcerned neutral material helpful as a binder. The excess of alumina in the first instance would not favor the formation of calcium aluminium sulphate, there being three essential factors involved instead of two. It has been known for some time that a valuable metallurgical cement could be produced by the substitution of a considerable portion of the alumina by iron oxide. Such a substitution, however, invariably results in the cement produced having a low initial hardening power.

Effect of Adding Blast Furnace Slag

Thirdly, there remains the very valuable means of arranging to have any possible free lime in the cement adequately combined chemically previous to its possible attack by the sulphates of ocean waters. It is this means which offers great possibilities of utility in concrete for coastal construction in seaboard localities of the United States. Research has established that additions of considerable quantities of blast furnace slag to the cements of oceanic concrete structures materially benefit the resultant concretes in resistant qualities. Through the action of these slags in chemically combining with available lime, subsequent reaction with the sulphates of the salt water is prevented. Quite satisfactory results have been secured from slag and cement mixtures being 20 to 40 parts by weight of cement.

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Fig. 3. Relationship of five different mixtures of blast furnace slag and portland cement and their respective resistance to 10 per cent magnesium sulphate solution over the time of 1 year

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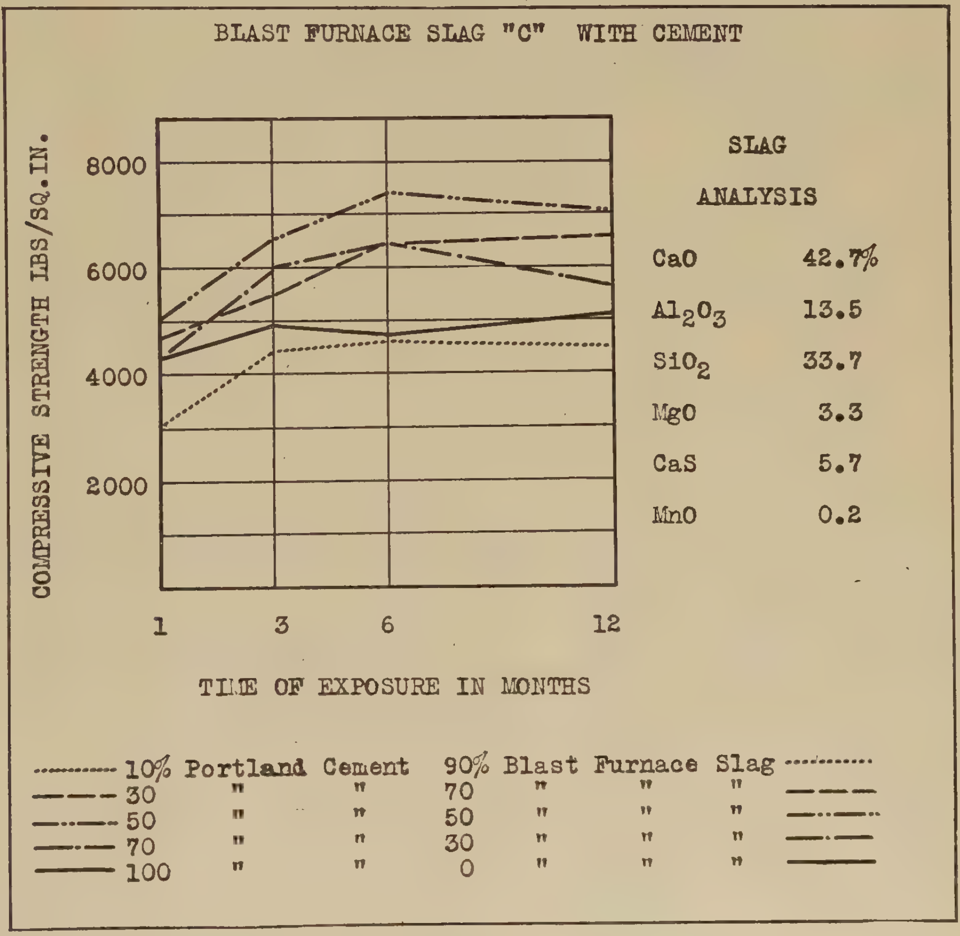

Of these ways in which the law of mass action suggests making a cement resistant to sea water, the employment of blast furnace slag with the binding cement plays a very important part. From the formula, $3CaO\ Al_2O_3\ CaSO_4\ 3H_2O$, it can be seen that it is many times more effective to reduce the average lime content in the binding cements than it is to reduce the alumina content a like amount, because much more lime takes part in the formation of the compound than does alumina. It is precisely this function which blast furnace slag incorporated with portland cement performs to render concrete more resistant to sea water. The fundamental value of this conception can be seen with greater clearness by reference to the adjoining series of curves which have been obtained from tests made of exposed mixtures of slag and portland cement in controlled magnesium sulphate solutions. Sea water contains .00265 per cent of sulphates,—the waters used in connection with the experiments to be mentioned were 8 per cent in sulphate content or approximately 3,000 times stronger than natural ocean waters in available sulphate.*

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*The curves of Figures 1, 2, 3, 4 and 5 have been taken from the translated work of Dr. Richard Gruen in his paper on "Beton im Meerwasser." Dr. Gruen is Director of the Institute for Research of the German Cement Industries.

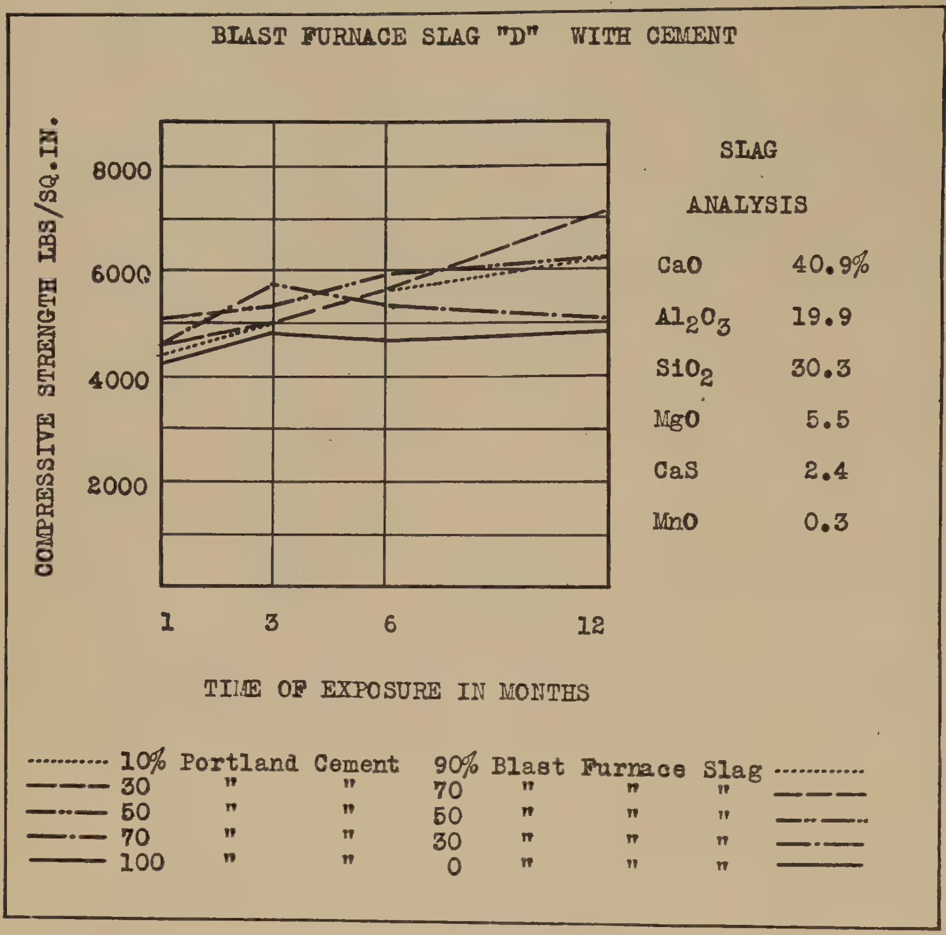

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Fig. 4. Relationship of five different mixtures of blast furnace slag and portland cement and their respective resistance to 10 per cent magnesium sulphate solution over the time of 1 year

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Fig. 5. Curves showing the relative resistance of varying mixtures of blast furnace slag and portland cement, the heavy lines representing water cured specimens and the dotted lines showing specimens cured in 10 per cent magnesium sulphate solution. Advantages may be seen in favor of the presence of slag where sulphate waters are encountered

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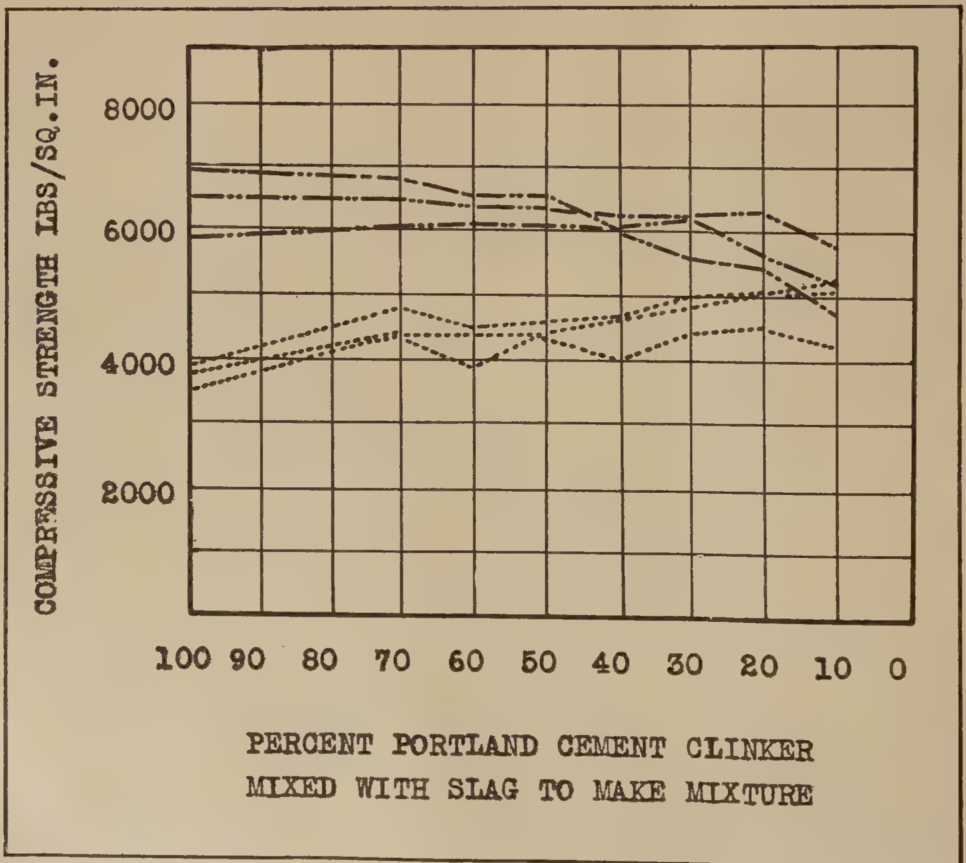

Discussion of Test Results

The curves shown in Figures 1, 2, 3 and 4 are those of the compressive strengths of various portland cement and blast furnace slag mixtures exposed to the action of magnesium sulphate solutions. Each of the four slags whose chemical analyses appear in connection with the curves have benefited the resistance factor materially. Mixtures of slags of these compositions in amounts exceeding half and half proportions with portland cement have increased the quality of resistance to the sulphate component of sea waters.

CONSTITUENT	PORTLAND CEMENT	ENSLEY SLAG	ALABAMA CITY SLAG	BLAST FURNACE "A"	ANALYSIS SLAG "B"	ANALYSIS SLAG "C"	ANALYSIS SLAG "D"
CaO	62.0	43.7	43.2	43.2	43.2	42.7	40.9
Al_2O_3	7.5	11.1		10.1	11.2	13.5	19.9
SiO_2	22.0	37.4	35.0	36.2	34.8	33.7	30.3
MgO	2.5	5.3	6.7	3.9	3.2	3.3	5.5
CaS	1.3	2.6	2.4	3.9	4.2	5.7	2.4
MnO		0.6		0.4	0.8	0.2	0.3

Fig. 6. Table showing the comparative analyses of portland cement, the two main blast furnace slags available in the southern states and the four slags utilized in connection with the sulphate water tests commented on in this paper

Tests have been made which indicate that the beneficial assistance conferred by slag additions is active over wide ranges. The curves on Figure 5 depict the gradually improved character of the cements obtained by replacement of greater and greater portions of portland cement. It will be seen that increased amounts of blast furnace slag will not necessarily improve concretes having exposure only to the usual fairly pure waters. The curves for water cured specimens trend in a direction opposite to those for sulphate water exposure.

The mechanical strengths obtained in these varieties of metallurgical cements according to Dr. Richard Gruen,† are practically the same as those found in portland cement, but the metallurgical cements present the added advantage of higher resistance to sea water. Blast furnace slag cement contains in the neighborhood of 53 per cent lime as against 63 per cent for portland cement. Sea water attacks concrete which contains free lime aggressively. The cements typified by those herewith described, because of their low lime content, contain practically no free lime. There is, therefore, much less chance of their being attacked by sea water than ordinary portland cement which often contains free lime in considerable quantities.

Blast Furnace Slag as Aggregate

The value which these blast furnace slags offer when mixed intimately with portland cements for oceanic concrete structures is not limited to being of advantage only when finely divided. As a large sized aggregate, blast furnace slag could not function in any other way than to render preservative service, its chemical composition being so averse to sea water attack. Moreover, a concrete which relies upon its ultimate strength coming from the binding cement could not be weakened by the use of a material as an aggregate which improves upon the lasting qualities of the portland cement matrix. That which would enhance the quality of a cement for sea water use, would do no other than raise the resisting power of a concrete subjected to ocean waters. There are many examples of time-tried sea wall construction in European waters in which blast furnace slag has performed as an aggregate equally well as it has functioned as a physical admixture with portland cement. According to Dr. J. E. Stead,‡ the sea piers at Skinninggrove, England, which were finished in 1891 and which were constructed with blast furnace slag as an aggregate in a matrix of slag cement and sand, are in an excellent condition after over 30 years of exposure to the action of the seas.

The accompanying table of analyses presents the comparative compositions of the available blast furnace slags in the southern states. The remarkable similarity of each of these slags to those seeing extensive utility in Europe in metallurgical cement manufacture is noteworthy.

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†Director of Research, Dusseldorf, Germany.

‡Metallurgist, Middlesbrough, England.

In view of the considerable scale on which the manufacture of these special cements is being carried out in Germany and in France, it may be expected that the time is not far distant when the severe inroads of the sea on coastal construction will fall under the control of man equally as well as have his other advances over ocean mysteries been secured. To secure a concrete of unquestioned resistance and permanence in coastal marine structures would doubtless be to score a considerable gain over ocean supremacy.

San Antonio to Get New $2,500,000 Cement Plant

Official Announcement Regarding Organization, Location and Future Plans

Public announcement was made in San Antonio on August 12th of the formation of the Republic Portland Cement Company, by J. H. Smith, president of the new corporation. The company will immediately erect a modern, million barrel per year cement plant costing approximately $2,500,000, according to Mr. Smith. The announcement further stated that the site had been purchased, practically all equipment ordered and in process of manufacture, and that every effort was being made to rush the plant to an early completion.

The new company is headed by J. H. Smith, president, W. M. Thornton, vice-president in active charge, F. A. Smith, J. W. Young, and A. F. Sayers. Engineering work for the company is being done by Terrell Bartlett, of San Antonio, and Richard K. Meade, who will act as consulting engineer.

The new plant will be located a short distance north of San Antonio, between the main lines of the M. K. & T. and Missouri Pacific railroads, near the Austin highway. The site for the plant consists of some 600 acres of ground, and according to tests conducted by Mr. Meade, will provide sufficient raw materials for more than 50 years of operation.

This plant to manufacture cement by the wet process will cost approximately $2,500,000 and its major machinery units will consist of two 11 by 250 ft. kilns for burning, four 8 by 7 by 40 ft. compeb mills for grinding, two 10 by 100 ft. coolers, and a large Dixie hammer mill for crushing. Orders for the kilns, mills, and coolers have already been placed with the Allis-Chalmers Company, of Milwaukee, Wis., and the first of these will be shipped about September 25th. The balance coming forward as rapidly as provision can be made for its installation. Contracts have been let to the General Electric Company for the installation of all electrical equipment which includes four 800-h.p. motors, two 300-h.p. units, and about eight units of 100 h.p. each. A feature of the new plant will be a 7½-ton P. & H. electric crane which will travel over a 70 by 350 ft. span in hauling raw materials.

The new product will be marketed under the trade name of "Longhorn" portland cement and the familiar head of the Texas longhorn steer will be used as a trademark on every sack.

The company will build a modern community to house its employees as soon as the main buildings are completed. This community will be known as Longhorn, Tex., and will be the shipping point for the product.

Construction work is already under way at the site with the M. K. & T. and M. P. railroads laying tracks to the plant property. Two wells have been drilled for water and construction equipment will be on the ground this week. A contract has been signed with the San Antonio Public Service Company for electric power and that company will build a large sub-station to serve the new industry. Natural gas will be purchased from the Southern Gas Company of San Antonio, and it is interesting to note that, excluding one other manufacturing concern, the new company will use as much natural gas in manufacturing its product as is consumed by the entire city of San Antonio.

The Republic Portland Cement company is in every sense a Texas concern; owned entirely by native Texans; selling its product in Texas; and formulating its policies with regard to Texas' needs and conditions.

In recent years J. H. Smith, president of the new company, has practically retired from the contracting field and has been devoting his efforts to the development of his San Antonio properties, which include, at this time, the Plaza Hotel, a 35-story office building, now under construction, and several smaller buildings located on what was formerly known as Bowen's Island. It has been known for some time that Mr. Smith contemplated the building of a cement plant, but this is the first official announcement of the details concerning it.

Coal Group Asks That State Buy Only Product of Mills Using Native Coal

A protest against the use of cement in Illinois roads other than that produced by mills using Illinois coal has been made by the Illinois Coal Sales Association, East St. Louis, Ill., to the state department of public works and buildings. The association was formed to promote the use of Illinois coal.

Much of the cement for building Illinois roads, the communication said, had been ordered from mills in the natural gas belt in Kansas, and from mills in Kentucky and Ohio.

The protest, in part, states:

"While there may be no law compelling the division of state highways to purchase cement from mills that use Illinois coal, we believe there is a direct obligation to do so in senate bill No. 559, approved July 6, 1927, providing for a buy-Illinois-products commissioner. How can the state consistently ask its people to patronize Illinois industries and then in turn discriminate against the coal industry of Illinois as in the present instance? The tax burdens of the people can be considerably lightened if the money is spent within our own state and with our own industries wherever possible. The sending of money outside the state will make them correspondingly heavier."

Ideal Cement Company Makes Last Call for Stock

Anxious to get its new financing plans under way, the Ideal Cement Company named July 25 as the last day on which interest would be paid on the 2,113 shares of preferred stock that were not tendered in exchange for its new 15-year, 5 per cent debentures. The Denver National Bank was named agent, paying $110.35 for every share of the outstanding preferred stock.

With all the preferred taken care of, it will have only 400,112 shares of common stock and the debentures, which means a saving of over $200,000 a year.

Resume of the World Trade in Portland Cement

Tendency of Industry Evidently Toward National Self-Sufficiency—Development of Latin-American Portland Cement Production Is Reflected in Increased Demand for the Product of United States Plants

By C. F. STEPHENSON
Minerals Division, U. S. Department of Commerce

THE world production of portland cement during 1927 was estimated at 396,541,730 barrels (barrel = 376 lbs.), as compared with an estimated production of 230,889,701 barrels during 1913. Of this 165,652,000-barrel increase, the United States accounted for 81,109,000 barrels, or nearly 49 per cent. The potential productive capacity of all the portland cement mills throughout the world at the end of 1927 is estimated at 541,510,000 barrels. The quantity of portland cement entering into international trade, based on export statistics of the leading portland cement producing countries, during 1927 amounted to 35,176,548 barrels, as compared with 26,525,312 during 1913. With the exception of Switzerland and Russia, every country that was a producer in 1913 had a larger output during 1927 than during 1913, and German cement mills during 1927 produced quantities equaling their pre-war production for the first time since the war. Several countries, moreover, which were noncement producers until the beginning of the present decade, now manufacture comparatively large quantities of this commodity.

Enormous Potential Capacity of World's Portland Cement Plants

The enormous potential capacity of the world's portland cement plants, estimated at 541,510,000 barrels, represents nearly 145,000,000 barrels more than were actually produced during 1927. Of this 145,000,000-barrel latency, United States mills alone account for nearly 54,000,000 barrels, or 37.1 per cent, and German mills for 22,000,000 barrels, or 15.1 per cent. The total production of portland cement plants in the United States for the year 1927 was 76.3 per cent of their indicated capacity at the close of the year, according to the June cement summary of the United States Bureau of Mines. The ratio of world production of portland cement to world capacity for the same year is estimated at 73.2 per cent.

Oversea Trade in Portland Cement

Oversea trade in portland cement has never been of great magnitude, principally because the raw materials necessary to its manufacture are so widely distributed throughout the universe as to permit the erection of cement mills in nonproducing countries as soon as demands therein become heavy. This statement, of course, is rather broad and is to be taken accordingly, yet the accompanying table shows that portland cement is now manufactured in 49 countries, or noncontiguous sections thereof, and it appears that capital is always available for the erection of new plants in any section of the world where sufficient demand is deemed to exist. Thus it might be said that the tendency throughout the world today is directed toward national self-sufficiency in portland cement.

A statement of this kind, however, demands certain modifications. Several countries which now produce portland cement in comparatively large quantities are still importing nearly as much as they did before plants were installed within their borders. The reasons are many. Among the most important are: (1) World demand for portland cement is steadily increasing; (2) foreign cement is still demanded in many of the home markets of the newly erected mills in Latin America and the Far East because of its reputed better quality; (3) lower production costs in certain European countries, combined with the ability of these same countries to ship their product to transoceanic markets at very low ocean freight rates, enable them to penetrate outlets thousands of miles away and to undersell the local product.

There are other factors, too, which deserve consideration in this connection. The Netherlands, for example, although possessing an abundance of raw material satisfactory for the manufacture of portland cement, has never produced more than negligible quantities, because the Belgian product and "dumped" German cement have been available in its markets at very low prices. It is said, however, that but little profit has accrued to the Belgians from their cement shipments into the Netherlands in recent years, and it is known that the German cement has been selling there at prices considerably under those within Germany itself. Some months ago, nevertheless, a year's agreement for a division of the Netherland market was made by the German and Belgian cement manufacturers. Shortly afterwards the price of portland cement in the Netherland market rose and, concomitantly, there was activity toward the completion of the new modern cement plant at Maastricht, in southeast Netherlands, started some years previous but never completed by its founders because they feared their inability to compete with foreign cement. The capacity of this new plant is estimated at 1,759,000 barrels, or 40 per cent of the Netherland present portland cement needs. It probably will begin actual production by the end of 1928. A price war hitherto had precluded the possibility of the profitable operation of any cement plants in the Netherlands.

South America More Independent and Cuba Practically Self-Sufficient

In this hemisphere, South America in general and Cuba are tending toward greater self-sufficiency in portland cement. During 1913 Cuba, with no local cement industry, imported 795,600 barrels. Cuban cement consumption during 1927 approximated 1,600,000 barrels, practically

ESTIMATED WORLD PRODUCTION AND TOTAL CAPACITY OF PORTLAND CEMENT MILLS, AND EXPORTS

	Estimated cement production 1913 Barrels	Estimated cement production 1927 Barrels	Estimated capacity 1927 Barrels	Exports 1913 Barrels	Exports 1927 Barrels
NORTH AMERICA:					
United States	92,097,131	173,206,513	227,080,000	3,999,715	816,829
Canada	8,650,000	9,000,000	14,886,000	1,800	262,160
Mexico	500,000	†1,000,000	1,400,000	—	—
Guatemala	—	35,000	40,000	—	—
Cuba	—	1,600,000	2,300,000	—	—
Total	101,247,131	184,841,513	245,706,000	4,001,515	1,078,989
EUROPE:					
Austria	(‡)	2,580,000	5,500,000	(‡)	120,000
Belgium	8,790,000	15,800,000	17,500,000	5,199,883	9,610,982
Czechoslovakia	(‡)	4,000,000	5,000,000	(‡)	—
Denmark	2,720,570	†3,336,217	4,400,000	1,404,310	1,903,000
Estonia	(‡)	500,000	876,000	(‡)	257,700
Finland	(‡)	1,200,000	1,400,000	(‡)	16,000
France	8,794,000	30,000,000	40,000,000	2,355,000	†2,928,000
Germany	42,802,000	42,000,000	66,000,000	6,623,000	6,804,000
Greece	—	657,000	880,000	—	30,000
Hungary	(‡)	2,500,000	4,300,000	(‡)	130,000
Austria-Hungary	14,000,000	—	—	784,000	—
Italy	8,000,000	15,000,000	19,000,000	129,000	46,000
Norway	450,000	2,200,000	2,650,000	36,668	872,000
Poland	(‡)	4,000,000	7,500,000	(‡)	746,000
Rumania	400,000	1,642,000	5,863,000	11,000	†94,000
Russia	11,000,000	9,000,000	15,800,000	35,000	175,000
Spain	2,345,000	†5,418,000	7,000,000	52,400	†847,000
Sweden	1,759,000	†2,775,000	3,500,000	803,706	†803,159
Switzerland	2,932,000	2,000,000	4,900,000	255,000	349,000
United Kingdom	17,000,000	29,000,000	31,000,000	4,541,333	4,496,760
Yugoslavia	(‡)	3,518,000	6,150,000	(‡)	1,800,000
Total	120,992,570	177,126,217	249,219,000	22,230,300	32,028,601
ASIA:					
Japan	3,742,000	15,000,000	19,000,000	158,477	1,685,000
China	1,650,000	3,000,000	4,000,000	—	—
India	60,000	2,000,000	3,225,000	—	—
Philippines	—	320,000	440,000	—	—
French Indo-China	1,000,000	2,000,000	2,200,000	100,000	381,000
Siam	—	150,000	210,000	—	—
Netherland East Indies	40,000	638,000	1,000,000	—	—
Turkey	50,000	200,000	230,000	—	—
Total	6,542,000	23,308,000	30,305,000	258,477	2,066,000
SOUTH AMERICA:					
Argentina	17,000	1,000,000	1,550,000	—	—
Bolivia	—	6,000	10,000	—	—
Brazil	15,000	400,000	1,000,000	—	—
Chile	100,000	600,000	1,000,000	—	—
Colombia	30,000	50,000	(§)	—	—
Ecuador	—	70,000	100,000	—	—
Peru	—	450,000	600,000	—	—
Uruguay	50,000	700,000	1,200,000	—	—
Venezuela	—	80,000	115,000	—	—
Total	212,000	3,356,000	5,575,000	—	—
AFRICA:					
Egypt	110,000	500,000	500,000	—	—
Morocco	—	40,000	45,000	—	—
Mozambique	—	120,000	200,000	—	—
Union of South Africa	800,000	2,000,000	3,100,000	—	—
Total	910,000	2,660,000	3,845,000	—	—
OCEANIA:					
Australia	586,000	4,400,000	5,860,000	5,020	2,758
New Zealand	400,000	†850,000	1,000,000	30,000	200
Total	986,000	5,250,000	6,860,000	35,020	2,958
Grand Total	230,889,701	396,541,730	541,510,000	26,525,312	35,176,548

†1926. ‡Not politically independent. §A new cement plant is in process of erection.

all of which was produced locally. Brazil, with a domestic production of 15,000 barrels in 1913, imported 2,728,000 during that year. In 1927 its domestic cement industry, working at full capacity, produced 400,000 barrels and 2,598,000 were imported.

The United States during 1913 produced 92,097,000 barrels of portland cement and imported 85,470 barrels. During 1927 the United States portland cement industry, with a capacity of 213,000,000 barrels and shipments amounting to 171,865,000, imported 2,050,000 barrels. Thus, even though the American cement industry was well able to take care of domestic portland cement requirements, and notwithstanding the enormous expanse lying between the United States and Europe, European cement was able to penetrate American seaboard markets owing to the price differential. The Cuban cement industry, on the other hand, with its plant located near the chief consuming centers and aided by governmental protection, was able to compete with foreign cement in practically every section of the island. (Cement imported into Cuba, originating in countries other than the United States, is dutiable at the rate of $0.50 per 100 gross kilos. Cement imported from the United States is dutiable at the rate of $0.40 per 100 gross kilos. There is also a surtax amounting to 3 per cent of the duty). Brazil's cement plant is located at Sao Paulo, a distance of about 320 miles from Rio de Janeiro. Its capacity recently has been increased to about 1,000,000 barrels a year. It will be interesting to see whether the product of this plant, reputed to be of as good quality as any, can compete with foreign cement in the Rio de Janeiro market.

Competition of Low-Cost Producers Expected to Continue

Whether international trade in portland cement will continue to increase notwithstanding the tendency toward national self-sufficiency remains a mooted question. It is certain that the consumption of portland cement throughout the world will continue to increase. It appears equally certain that countries like Belgium, with large modern cement plants in close proximity to excellent raw materials and fuel; with inland transportation costs to seaboard of only $0.28 to $0.42 per metric ton, according to distance of the haul; and with exceedingly low production costs, combined with the ability to ship the product to transoceanic markets at very low freight rates, enjoy advantages which will continue to permit them to compete not only in the market of countries in close territorial propinquity, but also of those far removed from their shores—if no artificial means are taken to retard them.

It has been said that the quantity of cement imported into the United States as compared with the amount produced by the American mills is too small to affect the prosperity of the American cement industry. This statement might be true if it were possible to distribute the imported cement throughout the entire United States, but the fact is that the bulk of our imported cement is sold in important seaboard markets and vitally militates against the prosperity of the domestic mills which were erected to take care of these requirements. For example, during 1925 almost 10 per cent of the cement consumed in Massachusetts was of foreign origin, during 1926 this item amounted to 20 per cent, during 1927 to 17 per cent, and for the first four months of 1928 to over 36 per cent.

Production, Capacity, and Export Data Compiled

The accompanying table gives the estimated production of portland cement for the years 1913 and 1927, the estimated total capacity of the mills at the end of 1927, and the exports during 1913 and 1927 by countries and continents.

Reasons for Decline in American Exports

Exports of portland cement from the United States have decreased from 4,000,000 barrels during 1913 to fewer than 817,000 in 1927, although the ratio of production to indicated capacity of the American portland cement industry was but 76.3 per cent last year. Sales of American cement abroad, outside of this hemisphere, always have been negligible—Canada, Cuba, Central and South America have always taken at least 95 per cent of the foreign cement shipments. (Commodity shipments from the United States to Porto Rico, Hawaii, and Alaska are not recorded by the United States customs as foreign; such trade is listed as "Commerce with noncontiguous territories of the United States.") One reason for the loss of the United States pre-war portland cement export trade is, of course, the inability to compete with low-priced European cement in foreign markets, notwithstanding the favorable impression American cement always has made therein because of its quality. European cement producers in many instances not only enjoy the natural and economic advantages mentioned heretofore—excellent raw materials, cheap inland water transportation, and propinquity to seaboard and low-priced labor—but often procure ocean transportation at very low, and sometimes at ballast, rates, because of the availability of space in steamers westbound from Europe to this hemisphere. Shipments from Central and South America to Europe consist mainly of raw or bulky materials which occupy large space; conversely, exports from Europe to Central and South America consist mainly of manufactured goods which occupy generally but small space in proportion to value, thus permitting the carriage of commodities like cement at low rates, not only to fill the ship but in many cases to obviate the necessity of handling ballast.

Principal United States Outlet More Self-Sustaining

These factors, important as they are, do not represent the principal reasons contributing to the loss of the United States portland cement export trade. During 1913, for example, five countries—Panama, Canada, Cuba, Brazil, and Mexico—together took 3,432,000 barrels, or 86 per cent of the American shipments abroad. Last year these same five countries took a total of 317,000 barrels, or 39 per cent of our 1927 cement exports. In 1913 construction of the Panama Canal was still active, which accounts for shipments there of 1,214,000 barrels, or 30 per cent of the total American foreign shipments. (All shipments from the United States to the Canal Zone carried in merchant vessels are considered as exports.) In 1913 Cuba purchased 697,000 barrels of cement from the United States; during 1927 United States cement shipments to Cuba amounted to but 107,000 barrels. Cuba possessed no domestic cement industry in 1913, whereas its domestic production in 1927 amounted to over 1,500,000 barrels. Brazil's domestic production of cement in 1927 was twenty-seven times as great as in 1913, and Mexico's cement industry now produces around a million barrels annually. Venezuela and Uruguay are the only South American countries which imported more cement from the United States in 1927 than in 1913. The increased American cement shipments to Venezuela in recent years have been used in connection with the expansion of its petroleum industry. At least 50 barrels of high-quality cement is required for every well drilled, and during 1926 and 1927, respectively, there were 358 and 393 oil wells drilled in Venezuela.

American shipments of cement abroad, it is evident, have shown a steady decrease since the war, primarily because Latin America, the principal foreign market, is becoming more and more self-sustaining in its cement requirements, and, secondly, because the completion of the Panama Canal necessarily greatly lessened demand for cement in this region.

Although United States exports of portland cement are steadily decreasing, notwithstanding the concerted efforts on the part of certain American manufacturers in recent years to increase this trade, the enormous latent strength of our portland cement industry is so great that it will continue to influence somewhat international trade in this commodity.

The Belgian Cement Industry Favorably Located

Belgium, from both a natural and an economic standpoint, is preeminently fitted for the manufacture and exportation of portland cement. During 1913 it produced approximately 8,790,000 barrels and exported about 5,200,000, or 59 per cent of its total production during that year. Belgian portland cement production in 1927 is estimated at 15,800,000 barrels, about 91 per cent of its indicated capacity, or an average of two barrels for every inhabitant of that country. This compares with a per capita cement production in the United States of 1.46 barrels; Denmark, 1 barrel; Norway, 0.8 barrel; and Germany, 0.7 barrel during the same year. Belgium's exports of cement during 1927 amounted to 9,611,000 barrels, or 60 per cent of its production for that year. During 1926 cement exports approximated 8,568,000 barrels.

The principal foreign markets for Belgian portland cement in 1913 were Argentina, the Netherlands, Great Britain, and Brazil. These four countries took more than 60 per cent of the total foreign shipments during that year. In 1926 and 1927, however, the United States, which imported but 600 barrels from Belgium during 1913, took, according to Belgian statistics, 2,172,158 and 1,392,163 barrels, respectively. (United States customs statistics record imports from Belgium during 1926 and 1927 as 2,407,013 barrels and 1,483,834 barrels, respectively.) These figures show that Belgium's exports of portland cement during 1926 and 1927 were, respectively, 3,367,677 and 4,411,099 barrels more than during 1913, and of this increase the American market alone accounted for 2,171,558 barrels during 1926 and 1,391,563 barrels during 1927. In 1926 the United States was Belgium's largest foreign cement market. During 1927 the Netherlands and Great Britain preceded the United States, which ranked third in importance. Latin America, as a whole, imported fewer barrels of cement from Belgium during 1926 and 1927 than during 1913, but the loss was more than compensated by increased shipments to the Netherlands, Great Britain, and to Belgium's new post-war market, the United States. The British cement manufacturers, as well as the American, are greatly concerned about the increasing use of Belgian cement in their respective domestic markets, but as yet neither of them has been able to do much to curb this trade because of price differential.

Local Market Consumes About 40 Per Cent of Present Belgian Production

No one can forecast the future geographic distribution of Belgium's cement exports, as the position of the Belgian producers in certain markets depends largely on the outcome of negotiations now in the making, and in which representatives from most of the European cement producing countries have participated. It is possible that the conclusion of these negotiations will preclude the sale of Belgian cement in certain European markets. If such an outcome is reached, Belgian producers will be forced to develop new outlets, or to attempt to increase their sales in some of their present markets, such, possibly, as Latin America and the United States, as the local market consumes only about 40 per cent of Belgium's present production. The new cement plant at present being erected (largely by Belgian capital) in the Netherlands, as mentioned before, will take care of about 40 per cent of the Netherland present portland cement needs. A large part of this important market, therefore, will be supplied by the local plant after 1928.

Calcium Dusts Found Harmless to Health but Conducive to Minor Respiratory Diseases

That the calcium dusts generated in the manufacture of portland cement do not predispose workers to tuberculosis or pneumonia is the finding of a study recently completed by the United States Public Health Service.

The investigation was conducted in one of the older, dustier plants. Records of all absences from work were kept for three years and the nature of disabling sickness was ascertained. Physical examinations were made, X-ray films taken, and the character and amounts of dust in the atmosphere of the plant were determined.

The workers exposed to dust experienced, however, an abnormal number of attacks of diseases of the upper respiratory tract, especially colds, acute bronchitis, diseases of the pharynx and tonsils, and also influenza or grippe. Attacks of these diseases serious enough to cause absence for two consecutive working days or longer occurred among the men in the dustier departments at a rate which was about 60 per cent above that of the men in the comparatively non-dusty departments. Limestone dust appeared to be slightly more deleterious in this respect than cement dust.

Outdoor work in all kinds of weather such as was experienced by the quarry workers appeared to predispose to diseases of the upper respiratory tract even more than did exposure to the calcium dusts. In the outdoor departments of the plant, also, the highest attack rates of rheumatism were found. The study also indicated that work in a cement dusty atmosphere may predispose to certain skin diseases such as boils, to conjunctivitis, and to deafness when cement dust in combination with ear wax forms plugs in the external ear. When the dust in the atmosphere is less than about ten million particles per cubic foot of air it is doubtful that the above mentioned diseases and conditions would be found at greater than average frequency.

International Earnings Show Slight Increase

The International Cement Corporation for the quarter ended June 30, 1928, reports net income of $1,128,529 after depreciation, federal taxes, etc., equivalent after 7 per cent preferred dividend requirements to $1.68 a share earned on 618,826 shares of no-par common stock. This compares with $1,067,928 or $1.60 a share on 562,500 common shares in preceding quarter and $1,142,253 or $1.74 a share on 562,500 common shares in second quarter of 1927.

Net income for first six months of 1928, totaled $2,196,458 after above charges equal to $3.14 a share on 618,826 common shares against $2,048,546 or $3.04 a share on 562,500 common shares in first six months of previous year.

~~ EDITORIAL ~~

Flattening the Consumption Curve

ONE of the greatest difficulties the cement industry has to contend with is the large seasonal fluctuations in both production and consumption. With a percentage relation of production to capacity of around 45 per cent in the winter and 90 to 95 per cent during the best summer months, there is a large overhead expense caused by the investment in equipment that is idle during the winter season.

It is not possible to flatten the production curve simply by operating at the normal average demand and storing cement or clinker in anticipation of the large shipment months. To some extent this procedure is, of course, practical and is now being followed, but the danger of losses from deterioration and the heavy storage expense make the adoption of this method impractical.

The only effective method appears to lie in the encouragement of winter construction or in winter purchases of cement. The early award of paving contracts as practiced in some states has an influence in flattening out the curve. Contractors who have been awarded contracts for the following season can get their equipment on the job, have a portion of the cement to be used delivered before actual work can start and then be ready to place concrete as soon as the weather is favorable. Such activity at least has the advantage of getting consumption started early in the season.

In winter construction, however, lies the greatest help. Undoubtedly this is becoming more popular, but as yet it has had only a slight effect in flattening the curve. Much promotional work must be done to that end. The Department of Commerce, under Secretary Hoover, has helped much by its campaign of encouraging winter work, but the construction industries and the material manufacturers themselves must get behind such a movement more aggressively. It would not be amiss if all industries interested would work co-operatively to attain this end.

Excess Capacity

NOT long ago a products manufacturer made this remark: "We certainly are having it soft when it comes to buying cement. There is a price war on and they darn near give us the cement if we will promise to return the bags. There is an element of humor in this, because they are the fellows who have been trying to tell us products manufacturers that we shouldn't cut prices. It is fine to preach, but when you are up against this problem of excess capacity yourself, it's a different story."

It is true that we are in a buyers' market and that there is excess capacity. But that in itself is not cause enough for destructive price cutting. The grasping for new markets, whether they yield a profit or not if only they will keep the plant running to capacity, starts the vicious circle of price cutting and further price cutting.

Only when this craze for volume at any cost is forgotten can there be any relief from price cutting. It means doing just what the cement industry has so thoroughly preached to the products manufacturer. Sales prices must be based on the cost of manufacture plus a reasonable profit. It is better to do a reasonable amount of business and make a profit on that than to do a large volume of business at a loss.

Criticism

FOR the past several weeks clippings from newspapers carrying the story that the Portland Cement Association has been charged with unfair methods of competition have been received from all sections of the country.

There is an old proverb to the effect that the way to avoid criticism is not to do anything. Anyone who is aggressively active is open to criticism and this seems to be the basis on which the charge is being brought before the Federal Trade Commission.

While all the facts regarding the alleged unfair practices are not now available, the past record of the promotional activities of the Portland Cement Association is clear and honorable. Every individual or every organization that has a commodity or an idea to sell must merchandise its wares aggressively. This the association has attempted to do in an ethical manner. It has worked for the best interests of the users of concrete and has fought practices that were antagonistic to this purpose.

It will be interesting to watch the development of this investigation, but the principles that guide the work of the employees of the association and its past record are an indication of the policies that guide its present activities.

The Preparation of the Raw Mix by the Dry Method

(Continued from page 104)

part of the silo formed a small enough angle to permit a complete drop of the material.

Knowing the surfaces of the filling and discharge processes of a silo, we can easily follow what happens when a silo is filled, discharged and the contents are taken to another silo, identical with it.

Returning to our hypothesis of a silo filled with five different mixes and forming five conical layers of equal thickness: A, B, C, D and E, we will plot over the filling diagram that of the discharge, dividing the latter into 10 zones of equal volume, numbered from 1 to 10. Fig. 2 shows the zones of discharge in full lines superimposed on the zones of filling indicated by dotted lines.

In discharging a silo, the contents of the first zone will contain only material A; that of the 2nd zone will have material A and B; the 3rd zone will have material A, B and C. It will be only after we get to zone 5 that we will find all material contained in the discharge.

In conveying the discharge to another silo we have accomplished the following: at the bottom of the silo a volume 1/10 of the total content of the silo will be composed of material of one kind; above it will be a layer of equal volume composed of two materials. Only after drawing 4/10 of the total volume of the silo, we will be drawing a mixture of all the materials, yet very little of A will be contained therein as it was drawn at the outset almost in its entirety.

Yet, if instead of filling another silo, the discharged contents are returned to the same silo, a zone rich in A forms above E, so that the 6th zone will be composed of all materials present in nearly equal amounts.

Therefore, before beginning the operation of mixing, it is necessary to draw about one-half of the contents of a silo gradually, returning it at the top. To repeat this procedure, as is recommended by several authorities, is unnecessary, as only the inner part of the contents of a silo enters the circulation, while the material around the periphery does not take part in this movement. Making a somewhat crude comparison, a chimney is produced inside the contents of the silo and only the material inside this chimney takes part in the movement.

Final Mixing

The final intimate mixing process will be obtained by other methods. One must assign to each device the task which is suitable to it and which it can best fulfill. The task of the mixing silos is not to produce an intimately homogeneous mix—we will see below what methods are used for this purpose—it is limited to a crude mixing and a fairly regular distribution of the different constituents contained in the silo, so that a sample of a definite volume, very small compared to the total contents of the silo and very large compared to the size of a particle, taken any number of times yields the same *average* composition as that of the contents of the silo. It is, if one wishes to call it that, a macro-mix.

This minimum volume of the sample is a measure of the homogeneity of the meal. For example, a silo filled with five different layers of material, will have a degree of homogeneity represented by a volume equal to that of the silo itself, for only the analysis of the entire contents would give us the average composition as registered by the analysis of the samples taken automatically, unless, indeed, we could analyze a section taken through the silo, which is obviously beside the point in practice.

On the other hand, the degree of homogeneity of ideally mixed raw materials would be the volume of particles of matter. It would be—to use the same terminology—a micro-mix.

It is only by steps that we can reduce the degree of homogeneity from the volume of the silo to that of one particle.

The first step we take by drawing and filling the same silo, as explained above, to the extent of one-half of its contents. The first operation will not change things much, yet it prepares the silo to yield, in being drawn, a mix which has the appearance of homogeneity, coarse as it may be.

This done, the contents of a silo must be taken to another silo. This operation completed, the homogeneity is improved to an extent making further transportation superfluous. The mix is not perfect, yet the rest is to be accomplished by the operations which follow:

Adjusting the Silo Discharge

If the average composition of a silo were exactly that desired, one could feed its contents directly to the kiln. However, generally a correction is necessary, which is made by mixing it with a certain proportion of another mix of different composition. The mixture is obtained by adjusting the discharge of the two silos in such a way that the quantities drawn are proportional to the computed ratio. When the discharge operation is certain—as it is in this country—the streams from each silo can be combined on the same conveyor and directed to the kiln. However, when the slightest doubt is entertained as to the functioning of the discharge (formation of voids at the discharge opening or clogging of the screws), it is preferable to convey the discharge to yet another silo where its composition can be checked and, if necessary, corrected, for it is impossible to correct the mix which has left the mixing silos.

Screw conveyors further heighten the homogeneity of the mix, as does the storage silo feeding the kiln and finally the grinding. However, in these stages one deals but with an intimate homogeneization, for a sample taken at the outlet of the storage bin, which should be of sufficiently large dimensions, should not show differences greater than 0.25 per cent $CaCO_3$.

Conclusions

Thus summing up, one can say that, if homogeneization of the raw mix by the dry process necessitates considerable work which is dispensed with in the wet process, the principles considered above prove that the mix thus obtained is in no way inferior to any slurry from the point of view of homogeneity, and that, consequently, the cements thus manufactured are just as good as those of the latter process.

It is only necessary to follow the following important directions:

1. Pulverize to a fineness not less than 12 per cent retained on the 4900-mesh sieve (4900 mesh per sq. cm.).
2. Before any other operation, draw and refill a silo to the extent of one-half of its contents.
3. Transport the contents of a silo thus treated to another silo.
4. Only then proceed with the correction of the mix in a new silo.

It is understood that all operations are controlled by frequent check tests of $CaCO_3$ content through all the phases of mixing.

Returning to what was said above, homogeneity is accomplished more easily and is more perfect the closer one of the constituents approaches the composition desired in the final product. It is thus important to have at the discharge of the mill a mix as nearly constant as possible and as close to the composition of the normal mix as can be expected. The ideal condition would be to have at this point a mix good enough to be sent to the kiln directly.

What are the conditions which lead to this? It suffices to:

1. Have raw materials of constant average composition.
2. Carefully supervise the weighing of materials before grinding.

With a good weighing device at the feed end of the mill, it is easy enough to satisfy the latter condition. However, the former condition presents more difficulties.

As a rule the limestones and shales in a quarry come from several deposits of different composition. It results that in sending a limestone from one part of the quarry to the mill, an entirely different $CaCO_3$ content is introduced that might be coming from some other part of the quarry. As one cannot establish the $CaCO_3$ of every car arriving from the quarry, the ground material shows variations in composition so that the contents of a silo may have an entirely different $CaCO_3$ content than that desired. To correct this, another mix should be added, which is also different from the desired composition.

This is particularly felt in small plants exploiting a quarry with a face of considerable extent. While one end is being quarried, the other is being uncovered and vice versa. Each change results in abrupt variations in the composition of the mix.

In other cases, where several faces are quarried, the reserve accumulated by one is followed by that of another and yet of another. As happens generally, the rock passes directly from car to crusher and from crusher to mill. Is there any reason to wonder why the composition is erratic?

To avoid these inconveniences, one should quarry simultaneously at as many points as possible and remove the rock in turn from one point after another, so that a crude mixture is obtained at the outset.

Even better results are obtained when the rock leaving the crusher is accumulated in a large bin from which it is drawn for the subsequent operations.

Finally, it is clear that a plant of large capacity has more of a chance of grinding a mix of uniform composition than a plant of small capacity, in which the defects of a few carloads are felt much more than when they are lost in a large quantity of other material.

In other words, the mixing of raw material should begin in the quarry. The old method of separating the rock of different deposits and basing the theoretical composition of the mix on that rock of so-called known composition, is to be condemned. Inconveniences can be the only result of this method.

Safety Council Sessions to Deal with Plant Problems

A special session devoted to organized safety work in the cement industry will be held on Tuesday morning, October 2nd, as a part of the Seventeenth Annual Safety Congress. The gathering is sponsored by the National Safety Council and will meet at the McAlpin Hotel from October 1st to 5th.

After the opening remarks of Chairman Town, there will be a general discussion of "What Organized Safety Work Has Done for the Cement Industry. Walter Clinton, of the Metropolitan Life Insurance Company, is to dwell on "Accident Prevention and Insurance."

At the joint meeting of the quarry and cement sections on the same day, R. P. Blake of the Independence Bureau, Philadelphia, will deliver a luncheon address. C. L. Baylor, assistant safety director of the Louisville Cement Company, Speed, Ind., will discuss "The Mental Causes of Accidents" at the afternoon session, followed by a round-table discussion led by S. Henry Harrison, assistant superintendent of the Vulcanite Portland Cement Company.

Quarry Section of Safety Council Meets October 2nd

How accidents are being reduced in the quarry industry is another subject of interest to cement mill operators. It will be discussed at a special session of the Seventeenth Annual Safety Congress to be held in the McAlpin Hotel, on Tuesday morning, October 2nd.

There will be 110 sessions, 325 speakers and 6,000 persons at the coming congress, according to present indications.

Complete details of the quarry section meeting will appear in the final edition of the congress program.

Talks scheduled include "What Safety Means to a Quarry Executive," by John Rice, president of the General Crushed Stone Company, Easton, Pa., "The Company Executive in Charge of Operation and Accident Prevention," by J. R. Davis, assistant vice-president of the U. S. Gypsum Company, and another by F. F. McLaughlin, superintendent of quarries of the Rock Cut Stone Company, Syracuse, New York, on "Getting Tonnage with Safety."

There will be no charge for admission and both members and non-members of the National Safety Council are invited to attend.

Idaho Portland Cement Company Organized

The Idaho Portland Cement Company has been recently organized and incorporated for $500,000. Sixty per cent of its stock is owned by Spokane, Washington, interests.

Work was to begin August 15th on a plant on property consisting of 160 acres close to the Union Pacific Railroad 9 miles east of Pocatello, Idaho. Initial capacity is to be 500,000 barrels a year, with the possibility of an increase both in production and equipment as the demand warrants.

Completion of the plant is scheduled for April, 1929.

Making Tests to Determine Location of Kentucky Plant

Tests of materials are being made following a personal inspection of more than 25 of the sites proposed by Kentucky towns interested in securing the $2,000,000 cement plant to be located somewhere in the Blue Grass state. Fifty-four sites have been entered.

Cement Plants to Pay Increased Taxes

The United States Portland Cement Company has been informed by the county that the valuation of the company's cement mill at Concrete, Colorado, has been raised from $321,000 to $825,000 and that the figure for the mill at Portland, Colorado, is also to be increased. It is understood that the company will accept the assessor's figures.

MEN and MILLS

Notes from the Field

John W. Boardman of Huron Portland Dies

John W. Boardman, vice-president of the Huron Portland Cement Company, Detroit, Mich., died Friday, August 3rd, at a Jackson, Michigan, hospital following a serious operation a fortnight previous. The funeral and burial took place at Jackson.

The portland cement industry was the hub of Mr. Boardman's business life. He began, in 1904, under his father, John W. Boardman, Sr., with the Southern States Portland Cement Company, Rockmart, Georgia, a branch of the Cowham system. He continued with the latter firm until 1914, when he joined the Huron Portland Cement Company as sales manager. He was later promoted to the vice-presidency and general sales managership of the company, the position which he held at the time of his death.

Throughout his career, Mr. Boardman took an active interest in national portland cement affairs. For the past six years he had been treasurer of the Portland Cement Association. He was one of a committee from America in attendance at the unveiling of the monument to Joseph Aspdin in England, in 1924.

At the time of his death Mr. Boardman was 43 years old.

Union Portland Cement Company Executive Killed

S. P. Dahlberg, 45, chief chemist for the Union Portland Cement Company at Devil's Slide, Utah, was killed July 24th, when an automobile in which he was a passenger overturned on a curve in the vicinity of Kemmerer, Wyoming. Two other occupants escaped with minor injuries.

Plant Employees Make Most of Holiday

Holidays come only at Christmas and the Fourth of July for employes of the No. 1 plant of the Penn-Dixie Cement Corporation and the latter consequently took a more than usually enthusiastic part in helping to celebrate the late Fourth.

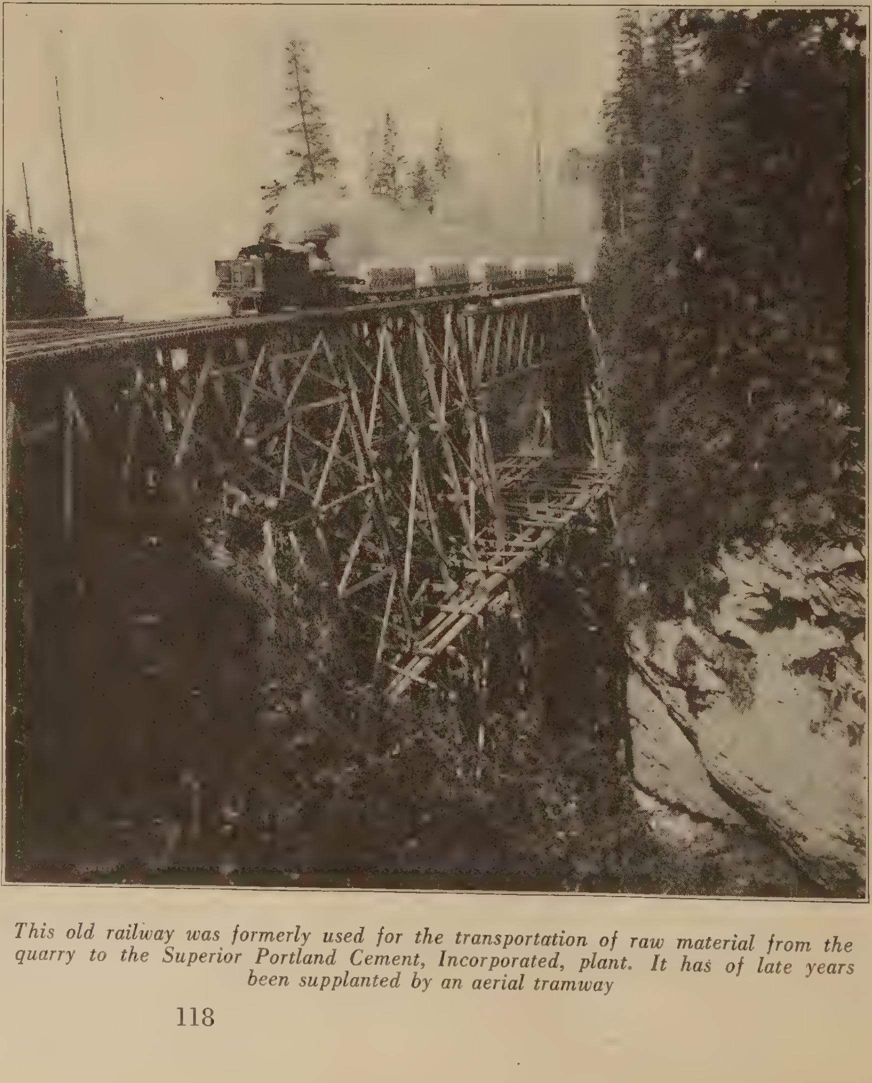
A parade float representing the Washington monument was conceived by one and successfully executed by a group previous to the holiday. Band concerts, an automobile polo game, and other amusements completed the day's program.

Oregon Portland Plans New Office and Warehouse Structure

The Oregon Portland Cement Company, Portland, Ore., has awarded a contract for the erection of a 3-story warehouse and office building. It is hoped to attain the highest type of beauty possible in a warehouse-type structure and concrete will be used.

The third floor will be occupied by the company offices. The balance will be devoted to warehouse purposes.

Among the Pines of Washington



This old railway was formerly used for the transportation of raw material from the quarry to the Superior Portland Cement, Incorporated, plant. It has of late years been supplanted by an aerial tramway

Like most of the new cement plants, that of the Lawrence Portland Cement Company at Thomaston, Maine, paid considerable attention to landscaping the grounds, particularly those surrounding the office

Louisville Cement Company's Dairy Herd Renowned

Found in the local press:

One of the features of this year's Speed Community Fair, which will be held at Speed (Ind.,) on August 15, 16 and 17, will be the Louisville Cement Company's dairy herd.

The herd at the Louisville Cement Company's dairy farm is fast becoming one of the best in the country. The farm is under the direction of Mr. Frank Richey, who is very proud of the herd he has built up.

Sybil's Golden Majesty Boy No. 278595, who is now the Prince of the Herd, will some day be the King. He is a very high type of animal of fine style and grace, carrying about with him always that superior air of a would-be king.

Another of the more important members of the ladies' herd—in fact, one of the top-notchers—is Jewel's Josephine Fox No. 488249.

Another lady of the herd who is running a close second is Miss Speed's Flora No. 585563.

Miss Speed's Flora is just as proud of her record as she is of being a native of the Speed farm.

Then there are many other pretty ladies in the herd. Some are still dainty little flappers who will some day contest for a record in production themselves.

Employees Enjoy Picnic Given by Superior Portland Cement

The second annual picnic given by Superior Portland Cement, Inc., for the entertainment of employees of the company and their families was held at Birdsview, near Concrete, Wash. Over 800 persons, including a large delegation from the Seattle office of the company, were present.

A ball game was the initial event on the program. The mill played the quarry and the latter was the victor. Contests were held following the picnic early in the afternoon.

At the conclusion of the sports program, all gathered around the speakers' stand, where C. N. Reitze, vice-president, presented the Eden cup to the winning baseball team. The cup was accepted by Fred Baker, manager of the team. John H. Kane, a director of the company, then made a short and appropriate talk, opening it with the reading of a telegram from President Eden expressing his regret at being unable to attend. Mr. Kane then complimented the workmen on the safety record they had made this year, with no lost time thus far, expressing the hope that the plant would close the year with a perfect record.

Service pins were then presented by Superintendent C. L. Wagner to the men entitled to them, as follows:

Twenty-year pins—Frank Bitonti, Ross Zongrone and L. B. McDaniel.

Fifteen-year pins—W. H. Biggerstaff, W. S. Gregory, M. M. Mount, Gordon Tongue, J. P. Brooks and John Martin.

Others received ten- and five-year pins.

Superior Portland First Aid Team in Contest

The first aid team recently organized by the safety committee of Superior Portland Cement, Inc., competed in the state safety contest held August 11th at Tacoma, Wash. The event was held under the direction of the safety bureau of the state department of labor and industry. Twenty teams, from every industry and from all parts of the state, participated. It is not yet known whether the Superior team achieved a place.

The members are Fred Baker, Ernest Lang, Walter Jungblom, Merlin Leonard, A. K. McClellan, Ole Nelson and E. M. Buchanan.

Koerper Advertising Club Official

Karl R. Koerper, advertising manager of the Ash Grove Lime and Cement Company, recently took office as the first vice-president of the Advertising Club of Kansas City.

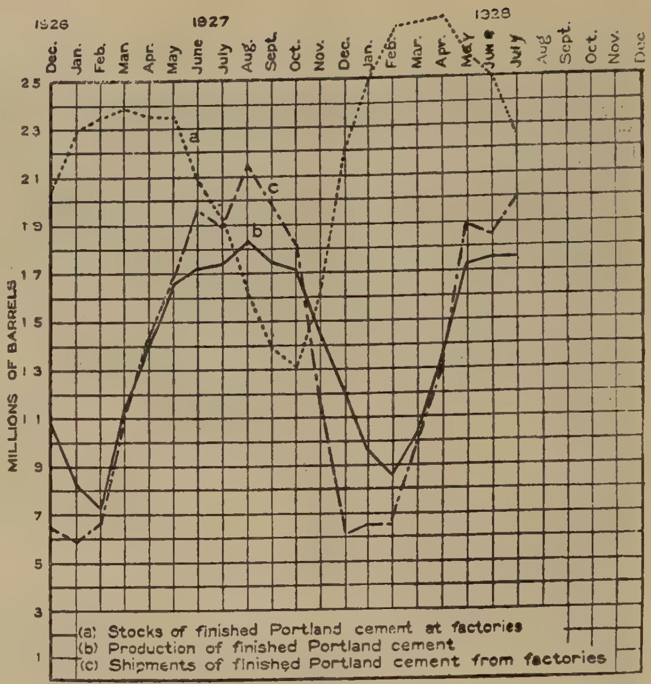
Cement Statistics for July

THE portland cement industry in July, 1928, produced 17,431,000 barrels, shipped 19,898,000 barrels from the mills, and had in stock at the end of the month 22,571,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of portland cement in July, 1928, showed an increase of 0.1 per cent and shipments an increase of 4.8 per cent, as compared with July, 1927. Portland cement stocks at the mills were 16.4 per cent higher than a year ago. The total production from January to July, 1928, inclusive, amounts to 94,436,000 barrels, compared with 92,466,000 barrels in the same period of 1927, and the total shipments from January to July, 1928, inclusive, amount to 93,851,000 barrels, compared with 93,759,000 barrels in the same period of 1927.

The statistics here presented are compiled from reports for July from all manufacturing plants except two for which estimates have been included in lieu of actual returns.

Relation of Production to Capacity

	July 1928	July 1927	June 1928	May 1928	April 1928
	Per cent	Per cent	Per cent	Per cent	Per cent
The month	87.0	90.4	90.1	86.6	70.0
The 12 months ended	73.7	73.9	73.8	73.9	74.0



Production, Shipments, and Stocks of Finished Portland Cement, by Districts, in July, 1927 and 1928, and Stocks in June, 1928, in Barrels

District	Production—July 1927	Production—July 1928	Shipments—July 1927	Shipments—July 1928	Stocks at end of month 1927	Stocks at end of month 1928	Stocks at end of June, 1928*
Eastern Pennsylvania, New Jersey, Md.	4,090,000	3,808,000	4,237,000	4,039,000	4,247,000	5,900,000	6,131,000
New York and Maine†	1,258,000	1,207,000	1,263,000	1,428,000	1,531,000	1,622,000	1,843,000
Ohio, Western Penn., and West Virginia	1,909,000	1,834,000	2,056,000	2,172,000	2,806,000	3,096,000	3,434,000
Michigan	1,460,000	1,662,000	1,674,000	1,872,000	1,743,000	1,755,000	1,965,000
Wisconsin, Illinois, Indiana, and Kentucky	2,360,000	2,365,000	2,935,000	2,863,000	1,857,000	2,506,000	3,004,000
Virginia, Tennessee, Ala., Ga., Fla., and La.	1,504,000	1,414,000	1,465,000	1,419,000	1,251,000	1,867,000	1,872,000
Eastern Missouri, Iowa, Minn., and So. Dak.	1,509,000	1,736,000	1,931,000	2,323,000	2,419,000	2,544,000	3,131,000
Western Missouri, Nebr., Kan., and Okla.	964,000	1,027,000	1,035,000	1,227,000	1,672,000	1,370,000	1,570,000
Texas	458,000	561,000	472,000	603,000	316,000	314,000	356,000
Colorado, Montana, and Utah	239,000	260,000	254,000	291,000	531,000	455,000	486,000
California	1,264,000	1,124,000	1,241,000	1,192,000	624,000	752,000	820,000
Oregon and Washington	393,000	433,000	421,000	469,000	400,000	390,000	426,000
	17,408,000	17,431,000	18,984,000	19,898,000	19,397,000	22,571,000	25,038,000

Production, Shipments, and Stocks of Finished Portland Cement, by Months, in 1927 and 1928, in Barrels

Month	Production 1927	Production 1928	Shipments 1927	Shipments 1928	Stocks at end of month 1927	Stocks at end of month 1928
January	8,258,000	9,768,000	5,968,000	6,541,000	22,914,000	25,116,000
February	7,377,000	8,797,000	6,731,000	6,563,000	23,563,000	27,349,000
March	11,450,000	10,223,000	11,100,000	10,135,000	23,922,000	27,445,000
April	14,048,000	13,468,000	14,350,000	13,307,000	23,654,000	27,627,000
May	16,701,000	17,280,000	16,865,000	18,986,000	23,503,000	25,972,000
June	17,224,000	17,469,000	19,761,000	18,421,000	20,972,000	*25,038,000
July	17,408,000	17,431,000	18,984,000	19,898,000	19,397,000	22,571,000
August	18,315,000		21,411,000		16,292,000	
September	17,505,000		19,828,000		13,996,000	
October	17,174,000		18,105,000		13,141,000	
November	14,449,000		11,619,000		16,022,000	
December	11,999,000		6,200,000		22,082,000	
	171,908,000		170,922,000			

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*Revised. †Maine began producing April, 1928, and shipping May, 1928.

With the Manufacturers

NOTES FROM THE FIELD

Rex Stock Listed

Stock in the *Chain Belt Company*, Milwaukee, was made available to the public after new financing with listing on the Chicago Stock Exchange recently.

Proceeds of the sale of additional shares, plus other funds, will be used to retire all the preferred stock of the company. The common stock, with 120,000 shares outstanding, will then represent the company's entire capitalization.

The company's balance sheet as of June 30, 1928, lists patterns, drawings, patents, trademarks, etc., at a nominal sum, although an appraisal of the value of these gave a worth in excess of $550,000. The company's products are three major lines—chain and transmission machinery, construction machinery and conveying machinery.

The Chain Belt Company was started with only $11,000 of capital when C. W. Levalley, F. W. Sivyer and W. A. Draves joined forces in 1891. The incorporation papers were not filed until September, 1892. Space was rented in a small building at Clinton and Lake Sts. The working force was three men with Mr. Levalley himself wielding one of the hammers.

Now there are 1,200 employes and 317,00 square feet of floor space, and 65 acres of land on which the plants are built. In 12 years the company's business has increased seven times.

Smidth Vice-President

CONCRETE has just learned of the retirement of *George M. Newcomer*, first vice-president of the *F. L. Smidth Company*. He is succeeded by *Harald Osterberg*, who has been in the service of the Smidth European company about twenty years.

Mr. Newcomer, who joined the F. L. Smidth Co. 33 years ago, has witnessed many changes and considerable growth in the cement industry.

His first connection with this industry was in 1893 when he was sales agent for the Aalborg Cement Company of Denmark. This cement was made from chalk. Quarrying methods at that plant were easy.

"A chute was formed in the 80-ft. chalk bank to the bottom of which a small industrial track was run. A man stood on the top of the bank and merely barred down chunks of chalk, which followed the chute to the car at the bottom. No drilling or blasting was necessary.

When Mr. Newcomer introduced this Danish cement, there was a plant near Phillipsburg, N. J.—an old Alpha plant—that was producing portland cement, with the first rotary kiln used in the United States. As Mr. Newcomer recalls it, this kiln was a 6- by 60-ft. unit. To Thomas Whitaker, president of the Alpha plant, is given the credit for making this type of kiln successful.

Wagner Electric Manager

The Wagner Electric Corporation announces that *Fred Johnson*, heretofore in charge of the Wagner Electric St. Louis sales office, is now manager of the Los Angeles branch office. This transfer brings to a close 21 years of service as district manager of the St. Louis territory.

Mr. Johnson has been connected with electrical sales activities ever since 1898, at which time he started to sell incandescent lamps for the Martin J. Insull Company of Chicago. In 1899 his employer became connected with the General Incandescent Arc Light Company, New York City, taking Mr. Johnson with him. In June, 1900, Mr. Johnson was made manager of the G. I. Company's St. Louis office district until that company went out of existence in 1906. Then he became connected with the General Electric Company's Chicago office, soon thereafter joining the Wagner Electric Corporation to take over the St. Louis district sales office, from which he has now been transferred to the Los Angeles office.

Renkin Department Manager

The *Combustion Engineering Corporation*, New York City, announces the appointment of *W. O. Renkin* as manager of the industrial furnace department, effective August 1st.

Mr. Renkin is well-known in the iron and steel industry, particularly as a pioneer in the application of pulverized fuel to metallurgical and industrial furnaces. Mr. Renkin has devoted the past fifteen years to this particular field of engineering.

Pipe Company Change

With the announcement of the completion of its new plant and the increase of its facilities some 200 per cent, the company formerly known as the *Naylor Spiral Pipe Company* also announces the change in name to the *Naylor Pipe Company*.

The new product of this organization, *Spiralweld Toncan* iron pipe, no longer being comparable to light weight, sheet metal pipe, but putting it rather in the category of standard weight pipe, has necessitated the increased facilities as well as the change in company name.

There will be no change in management, all officers and executives carrying on in their respective positions.

New Chain Belt Building

The Chain Belt Company began work August 17th on a new manufacturing building on its 59-acre tract at 39th and Orchard Street, Milwaukee. This is the fourth unit to be erected and is a part of a general plan for extension.

The new building will be 104 by 150 ft., and is to be completed by Sept. 15th. It will be modern in every respect, with a saw-tooth roof, brick and concrete sidewalk construction and concrete flooring throughout. At present there are five buildings on this tract, the malleable iron foundry, concrete mixer assembly plant, and the general engineering building where conveying systems and REX traveling water screens are manufactured.

The main office remains in the 16th St. viaduct at Milwaukee.

INDUSTRIAL LITERATURE

On Thermometers

The Brown Instrument Company, Philadelphia, Pa., has just completed the publication of its *Resistance Thermometer Catalog No.* 93. It describes in a complete way the applications and types of Brown resistance thermometers as applied to modern industry, including their advantages, use, operation and the individual models and parts.

Celite Publication

Bulletin No. 101, which has just been published on *"Sil-O-Cel Insulating Materials and Allied Products,"* has been received from the *Celite Products Co.*

This bulletin, which has 16 8½x11-inch pages with 30 illustrations, contains a detailed description of all *Sil-O-Cel* insulating products, namely, standard brick, C-22 brick, super brick, rotary kiln brick, powder and coarse grades, C-3 and C-3 concrete, blocks, plastic and hard finish cements, as well as Fraxite high temperature cement and Celcote waterproofing.

Charts showing the conductivities of the various insulating materials are included as well as information on methods of using the materials in heated equipment.

Mill Equipment

New Radiation Pyrometer

The K & S pocket radiation pyrometer is a new development of the "total radiation" type. It operates on the principle of the measurement of the total radient energy emitted by a hot body, whose temperature is to be determined.

The scale of the instrument is transparent and can be seen at the same time the glowing surface is viewed through the ocular, enlarged about eight times. To protect the eye against the bright rays when measuring high temperature, a red glass is provided to place between the eye and the ocular.

The pyrometer, the manufacturer states, contains all the necessary parts for accurate temperature measurement in the one small portable unit. All working parts are completely enclosed and protected in a dustproof housing. The overall dimensions are 6 in., by 2 in. in diameter; the weight is 6 oz.

The instrument has a "distance factor" of about 12. Thus the distance from the instrument to the furnace opening or piece of material whose temperature is to be measured should not be more than 12 times the diameter of the opening or piece.

The instrument is distributed by the Colonial Supply Company, Pittsburgh, Pa.

INDUSTRIAL LITERATURE

(Continued)

"Blaster's Handbook"

A new and revised edition of the *"Blaster's Handbook"* has just been issued by the explosives department of *E. I. du Pont de Nemours & Company.* The volume was prepared under the direction of Arthur La Motte, manager of the technical section. It contains 214 pages and is of handy pocket size.

Among important new matter which appears in this edition is a section devoted to description of the character and uses of pellet powder, said to be a relatively new type of explosive so far as the United States is concerned, which offers many advantages for use where permissible explosives are not needed. There is also description of the low density du Pont Extra dynamites, which are designed to reduce explosives costs in blasting soft ore, soft limestone, salt, gypsum and clay; and of Agritol, a similar explosive for agricultural blasting.

The section on electric firing shows a new type of delay electric blasting cap and gives examples of the method of calculating the electric current required for firing various types of blasting circuits. Especially interesting is the discussion of methods of safeguarding electric firing underground against the hazards of premature application of the current to the blasting circuit and of the passage of stray current into the circuit.

Crawler Crane Book

The new "Built for Service" *Crawler Crane Book No.* 995 just issued by *Link-Belt Company,* covers the complete Link-Belt line of gasoline, diesel and electric crawler cranes of capacities up to and including the 2 cu. yd. heavy duty machine as well as standard locomotive cranes.

The book is generously illustrated to show the use of the dragline, dipper and trench shovels, skimmer scoop, hook block, pile driver, and other attachments which may be used without changing or disturbing the bodies of the machines.

Data on lifting capacities, approximate operating speeds, line pull, tractive effort, etc., is given. The tables in which this data is arranged have been supplemented by line drawings which show dimensions for operating limits.

An interesting feature of the book is the fact that illustrations and complete specifications of the new K-55 2 cu. yd. capacity heavy duty crane are shown. This crane is the only one of its size which can be transported from job to job loaded on a flat car without dismantling, it is said.

The final portion of the book is devoted to illustrations of standard and long-radius locomotive cranes, and other loading and unloading equipment.

Boilers Above Requirements

One of the *International Combustion Engineering Corporation* publications, *The Safety Valve,* in its April issue, presents some of the points in which the regular construction of Heine and Ladd boilers exceeds the requirements of the A. S. M. E. Code.

The publication also goes quite thoroughly into descriptions of the details of construction.

Plastic Refractory Makes Monolithic Lining

Nojoint is a plastic refractory for complete monolithic kiln linings and repairs and is said to be impervious to hot gases and air. It may be installed by common labor equipped with a trowel and mallet, and it presents a jointless, monolithic surface, according to the manufacturers.

It is suggested as valuable for sidewalls, bridge-walls, door arches and jambs of small boiler furnaces, and baffle walls.

The manufacturer emphasizes the quality of the clays comprising it, stating that they are taken from the Olive Hill, Kentucky, district and possess to the highest degree the chemical and physical characteristics essential for efficient service and analyzing very high in alumina and low in impurities.

The product is shipped in barrels, which are split open and from which the refractory is cut into pieces. These are then pounded into place.

Nojoint is manufactured by the Ironton Fire Brick Company, Ironton, Ohio.

New Line of Totally Enclosed Fan Cooled Motors

A new line of totally enclosed, fan-cooled motors, 1 to 50 h.p., has been developed by Allis-Chalmers Manufacturing Company. In this new design, all of the active parts, such as stator core, stator winding and the rotor, are completely enclosed, preventing contact of outside air, dust, fumes, moisture, etc., with the interior or active parts.

Heat is carried away by a sufficient volume of cooling air forced around and across those parts which conduct the heat from the interior to the outer surfaces. A circumferential air jacket controls the path of cooling air. Solid cast iron bearing housings are attached to stator end heads with machined fit, which, with grease packed bearings, form a perfect end closure.

Internal parts of motor are readily accessible by removal of housings. A unique feature is that in many ratings, this totally enclosed design delivers the same horsepower output as is obtained from the same frame in the standard open rating. Temperature rise is within 55 deg. C. measured by the resistance method. The design provides for a most rugged construction with a minimum number of parts.

HEINE BOILERS

in Every One of the 48 States

THIS nation wide recognition of Heine Boiler efficiency has been earned through adhering—over a period of forty-six years of boiler building—to the principle of designing and building up to the highest standards of boiler engineering, instead of down to the minimum requirements of a code.

Engineers who have specified Heine Boilers have the satisfaction, year after year, of witnessing the soundness of their judgment reflected in the operating efficiency, the reliability and low upkeep cost of their boiler units.

When you buy a boiler you make a long term investment. You purchase equipment whose daily operation will either be a source of pride or a constant reminder of poor judgment. The useful life of a steam boiler should be from twenty to twenty-five years, or longer—provided the unit is correctly designed and applied, honestly built and properly operated and maintained.

Scores of Heine Boilers installed well over a quarter of a century ago are today rendering efficient and economical service.

A type of boiler for every service—every pressure.

HEINE BOILER COMPANY

International Combustion Building **200 Madison Avenue, New York**

A SUBSIDIARY OF INTERNATIONAL COMBUSTION ENGINEERING CORPORATION

Marquette Construction to Include Addition to Present Plant

Five hundred men are employed on a 24-hour basis in the construction of the Marquette Cement Company's new unit at LaSalle, Ill., and work is proceeding according to schedule. Completion is anticipated by January, 1929, or shortly thereafter.

The addition is to include 48 storage bins which will increase by 1,000,000 barrels the present 500,000-barrel storage capacity. Two kilns are under way and two 350-ft. stacks are being built.

In addition to the entirely new unit of the plant directly south of the present mill, a considerable expansion is to be made in the present plant, including the installation of a new raw grinding department, the placing of a modern dust collector system and the installation of an eighth kiln. Several large turbine engines and an additional waste heat boiler also are being added to the present plant.

Bessemer Interests Vote to Increase Stock to Finance Peerless Purchase

A special stockholders meeting of Bessemer Securities Company was called for on August 27th to act upon a proposal to increase capital stock from 120,000 shares of no-par value to 200,000 shares. Substantially all of the original authorization was issued at $30 per share. Proceeds were invested in preferred stock of the Federal Portland Cement Co. and in Class B stock of the Bessemer Limestone & Cement Co.

The Bessemer Securities recently purchased a large block of stock in the Peerless Egyptian Cement Co. of Detroit, as announced in the August issue of CONCRETE.

The proposal was to sell between 25,000 and 30,000 shares of the new authorization at $30 per share. Proceeds of the current sale will be used to pay for stock purchased in the Detroit company. Bessemer Securities is likewise planning to enter the Chicago territory.

Universal Steamer Transports Largest Cargo

Carrying the largest cargo ever transported on the Great Lakes, the steamer *Carl D. Bradley*, said to be the largest and fastest boat on the lakes, nosed into the Buffington, Ind., harbor of the Universal Portland Cement Company on July 27th with 16,033 gross tons of limestone.

Immediately upon its arrival the *Bradley*, which is a self-unloading vessel, began with its own automatic electrical machinery to discharge its cargo at the rate of a ton a second. The limestone came from the Michigan Limestone and Chemical Company's quarry at Calcite, Mich., the largest quarry in the world, and will be used in the manufacture of cement. Loading and receiving this unusual cargo were made possible by the depth of the Calcite and Buffington harbors, which are among the deepest on the Great Lakes.

Governor Declares Michigan State Cement Plant Is Making Money

In an address recently before a county officials' group, Governor Fred W. Green of Michigan declared that the state cement plant at Chelsea had undergone a complete audit and has begun making money.

"By completely doing away with all of the high priced officials," he said, "I have been able to place the Chelsea cement plant on a paying basis. I never did say that Michigan made a mistake in buying it. I said that the people were defrauded and that as long as it continued as it had, they would continue to lose money."

The last previous report stated that the question of whether the plant should be continued in operation "at a loss at the present time as one of Jackson prison's industries" or be closed down but kept in operating condition as a guard against high cement prices, would be considered shortly by the state administrative board.

The governor maintains, however, that there is a question as to the legality of the state purchasing the plant without the consent of the legislature, and if the plant is to be sold, it is up to the legislature and not to the governor and the administrative board.

Bituminous Coal Stocks Decline in June

On July 1st bituminous coal stocks in industries in the United States showed a further decline of one million tons from last month. Total stocks of both anthracite and bituminous in the United States and Canada as of July 1st were slightly less than 40 million tons.

Consumption dropped off approximately 2 1/3 million tons during the month of June as compared with May to approximately 32½ million tons, making the number of days' supply of coal on hand 37 days.

Bituminous coal production, however, dropped off in June as compared with May less than 1 million tons due to increased shipments up the lake which partially offset the decrease in industrial consumption.

Anthracite production dropped off considerably as retailers had stocked up prior to June 1st, production being 2,800,000 tons lower than the preceding month. Since July 1st there have been further heavy cuts in stocks particularly among the utilities and railroads, other stocks being down on a fairly low level. It is anticipated that by the end of July, the reduction in stocks will have been fairly well completed.

Hercules May Increase Capital Stock

A special meeting of stockholders of the Hercules Cement Corporation, the outcome of which is not yet known, was held late in August at the company's offices at Philadelphia to vote on a proposal to increase the authorized capital stock to 35,000 shares. These would be comprised of 5,000 shares of preferred par $100, and 30,000 shares of common without nominal or par value.

The present authorized capital is 25,000 shares, of which 5,000 are preferred and 20,000 common.

Riverside Declares Dividends

The Riverside Cement Company, successor to the Riverside Portland Cement Company, has declared an initial quarterly dividend of $1.62½ on its cumulative preferred and its $1.25 dividend on cumulative participating Class A stock payable August 1st to stock of record of July 14th.

The stock of the reorganized firm has recently been added to the listings of the Los Angeles Curb Exchange. The listing consists of 65,000 shares of first preferred no par value $6 stock and 240,000 shares of Class A no par $1.25 stock.